BJC/OR-1236/R1

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Environmental Baseline Survey Report for the Title Transfer of the K-1007 Building at the East Tennessee Technology Park, Oak Ridge, Tennessee

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Environmental Baseline Survey Report for the Title Transfer of the K-1007 Building at the East Tennessee Technology Park, Oak Ridge, Tennessee

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This report is intended to be used in its entirety. Excerpts, which are taken out-of-context, run the risk of being misinterpreted and are, therefore, not representative of the findings of this assessment. Opinions and recommendations presented in this report apply only to site conditions and features as they existed at the time of SAIC's site visit, and those inferred from information observed or available at that time, and cannot be applied to conditions and features of which SAIC is unaware and has not had the opportunity to evaluate.

The results of this report are based on record reviews, site reconnaissance, interviews, and the radiological report reviewed and approved by BJC. SAIC has not made, nor has it been asked to make, any independent investigation concerning the accuracy, reliability, or completeness of such information.

All sources of information on which SAIC has relied in making its conclusions are identified in Chap. 7 of this report. Any information, regardless of its source, not listed in Chap. 7 has not been evaluated or relied upon by SAIC in the context of this report.

CONTENTS

FIGURES

TABLES

ACRONYMS

ACM	asbestos-containing material
bgs	below ground surface
BJC	Bechtel Jacobs Company LLC
CDR	Covenant Deferral Request
CFR	*Code of Federal Regulations*
COE	U. S. Army Corps of Engineers
CPU	central processing unit
CROET	Community Reuse Organization of East Tennessee
DCGL	derived concentration guideline level
$DCGL_{EMC}$	derived concentration guideline $level_{elevated\ measurement\ comparison}$
DOE	U. S. Department of Energy
dpm	disintegrations per minute
EBS	Environmental Baseline Survey Report
EPA	U. S. Environmental Protection Agency
ESU	exterior survey unit
ETTP	East Tennessee Technology Park
FFA	Federal Facility Agreement
FSU	furnishings survey unit
IBM	International Business Machines
ISU	interior survey unit
LAW	large area wipe
MARSSIM	*Multi-Agency Radiation Survey and Site Investigation Manual*
MSDS	Material Safety Data Sheet
NaI	sodium iodide
NORM	naturally occurring radioactive material
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORR	Oak Ridge Reservation
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RADCON	Radiological Control Organization
RCRA	Resource Conservation and Recovery Act of 1976
ROD	Record of Decision
TRU	transuranic
TVA	Tennessee Valley Authority
UST	underground storage tank

EXECUTIVE SUMMARY

This environmental baseline survey (EBS) documents the baseline environmental conditions of the U. S. Department of Energy's (DOE's) K-1007 building and K-1007-A Canteen at the East Tennessee Technology Park (ETTP). DOE is proposing to transfer the title of this building to the Community Reuse Organization of East Tennessee or one of its subsidiaries. This report provides supporting information for the transfer of this government-owned facility at ETTP for reuse and redevelopment by a private company. This EBS is based upon the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

A previous baseline report, *Baseline Environmental Analysis Report for Building K-1007 and Adjacent Areas*, BJC/OR-71, was published in 1998 for Bldg. K-1007 when portions of the building were being proposed for lease to CROET.

Building K-1007 is located in the southern portion of ETTP, west of the main entrance (Portal 2), off the Oak Ridge Turnpike/Highway 58. It is a two-story, concrete-framed building with over 113,000 ft^2 of floor space and has been used as an office area and systems support building for ETTP. Portions of the building have been leased since 1998.

Preparation of this report included the review of government records, title documents, aerial photos, visual inspections of the property and adjacent properties, and interviews with current and former employees[1] to identify any areas on the property where hazardous substances and petroleum products were stored for 1 year or more, known to have been released, or disposed of. Radiological surveys were conducted to assess radiological contamination. Following is a summary of the findings of the evaluation that was performed:

- There are several historical environmental restoration sites in the area surrounding the K-1007 building. They are listed in the Oak Ridge Reservation Federal Facility Agreement and may require future remedial and/or corrective action.

- No chemicals exceeding 1000 kg have been stored and/or used at Bldg. K-1007 for one or more years, although numerous chemicals have been used for various activities since 1960. These include 126 lbs (57 kg) of sulfuric acid (emergency wet-cell batteries), 1250 lbs (567 kg) of Freon 12 and 750 lbs (340 kg) of Freon 22 (air conditioning systems), 26 canisters of Halon 1301 (fire suppression system), and 50 gal of photographic developers and fixers.

- Asbestos is present in the building in the form of piping insulation and is considered to be present in the vinyl floor tiles. It is estimated that there are 81,260 ft^2 of vinyl floor tile, 200 ft^2 of wall panels, 431 linear ft of insulation, and 453 fittings that might contain asbestos. There are an additional 18,048 ft^2 of raised floor panels in the machine rooms that are not suspected to contain asbestos. The insulation and most of the floor tiles are in good condition. There are a few broken tiles in the switchgear room and in the K-1007-A Canteen.

- Due to the age of K-1007 (built in 1960), it is assumed that the ballasts in some of the older fluorescent lighting fixtures contain low concentrations of polychlorinated biphenyls and that lead-based paint has been used throughout the building.

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[1]Personal communications with Lynn Denton, Joe Keen, Marvin Anderson, Lynn Francis, Steve Goodpasture, and Ray Russell (either previously or currently employed at the East Tennessee Technology Park).

- There was no evidence found of a release of hazardous substances or petroleum products in excess of the substance's reportable quantity occurring in the K-1007 building. In 1986, however, there was a release of less than 100 gal of gasoline from an underground storage tank outside Bldg. K-1007 (it was subsequently cleaned up). See Sect. 4.2 for more information.

- No soil sampling was conducted for this report since no exterior areas are included in the proposal for title transfer.

- The building interior, exterior, and furnishings were radiologically surveyed in accordance with the survey plan (Appendix D). The data were analyzed using the Sign test, a non-parametric statistical test, to determine if any residual contamination was present and if the contamination may exceed the derived concentration guideline level (DCGL) established for each of the survey units. Survey results showed that the K-1007 study area had no areas of elevated residual radioactivity present above DOE contamination limits or the DCGL and, therefore, can be radiologically released. The radiological survey results are discussed in Sect. 6.3 of this report.

CONCLUSIONS

Based on the U. S. Department of Energy's (DOE's) review of the existing information, including discussions and interviews referenced herein, and evaluation of the data gathered in preparation of the environmental baseline survey for Bldg. K-1007, DOE recommends the following:

1. Due to the uncertainty associated with the nature of the on-site groundwater and the need to evaluate and possibly address groundwater issues in the future, DOE recommends that the transfer of Bldg. K-1007 be achieved by a covenant deferral per the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Sect. 120(h)(3)(c), et seq.

2. Because the piping insulation and vinyl tiles may have asbestos-containing materials (ACMs), they should be periodically inspected to ensure that the asbestos does not become friable. Disposal of the materials, notwithstanding their condition, must be conducted pursuant to applicable regulations.

3. Due to its age, K-1007 may contain lead-based paint, formerly in common use. Paint chips should be managed pursuant to applicable regulations. Also, due to the buildings age, the ballasts in some of the older fluorescent lighting fixtures may contain low concentrations of polychlorinated biphenyls. Light ballasts should be managed pursuant to applicable regulations.

LAND USE RESTRICTIONS

Land use restrictions are an important component of a CERCLA covenant deferral; they help to ensure that transfer of the property is protective for the intended use. The restrictions that will apply to Bldg. K-1007 are summarized below. Full details are found in the Covenant Deferral Request package.

1. Extraction, consumption, exposure or use in any way of the groundwater underlying the property or water from any streams or ponds located on the property is prohibited.

2. Development of the property must comply with all applicable federal, state and local laws and regulations. Development activities must follow the East Tennessee Technology Park (ETTP) site procedures for obtaining excavation and penetration permits, and construction of basements is prohibited.

3. The property shall not be used or developed in a manner that is inconsistent with the land use assumptions of "unrestricted industrial use" contained in the *Record of Decision for Interim Remediation of Contaminated Soil, Material, and Buried Waste in Zone 1 of the East Tennessee Technology Park* (DOE 2002a). Accordingly, use of the area of the property below 10 ft is prohibited.

4. In order to ensure that the vapor intrusion pathway (i.e., the migration of volatile organic compounds in contaminated groundwater and/or soil to indoor air) does not contribute to an unacceptable risk to human health; DOE will address the potential for vapor intrusion in the ETTP Groundwater Record of Decision (ROD) currently scheduled to be signed by 2006; and will take interim measures to ensure protectiveness until the ROD is signed. The interim measures to be implemented include: collection of samples inside the building to confirm the pre-transfer determination that the vapor intrusion pathway does not pose a significant risk to human health, and making physical modifications to the facility as necessary to ensure protection or otherwise monitoring the stability of groundwater conditions and change in the building.

RESPONSE TO REGULATOR COMMENTS

In May 2003, DOE received a number of comments from Region 4 of the U. S. Environmental Protection Agency (EPA) on document content and level of detail. Changes in response to those comments have been incorporated throughout this report. Additional comments from EPA, the DOE Oversight Division of the Tennessee Department of Environment and Conservation, and members of the public will be included in the final version of the report.

1. PROPERTY IDENTIFICATION

The K-1007 building and K-1007-A Canteen discussed in this environmental baseline survey are located in the southern portion of the East Tennessee Technology Park (ETTP) [formerly the K-25 Site] on the Oak Ridge Reservation (ORR) in Roane County, Tennessee. The study area is located to the west of the main entrance to ETTP, Portal 2, and is outside of the main plant perimeter fence. Figure 1.1 is a map showing the relationship of Bldg. K-1007 to ETTP, and Fig. 1.2 is an ortho image showing the footprint of the K-1007 study area. Figure 1.3 is a 1995 aerial photograph of K-1007 from the northeast.

Preparation of this report included the review of government records, title documents, aerial photos, visual inspections of the property and adjacent properties, and interviews with current and former employees[2] to identify any areas on the property where hazardous substances and petroleum products were stored for one year or more, known to have been released, or disposed (BJC 2002a).

[2]Personal communications with Lynn Denton, Joe Keen, Marvin Anderson, Lynn Francis, Steve Goodpasture, and Ray Russell (either previously or currently employed at the East Tennessee Technology Park).

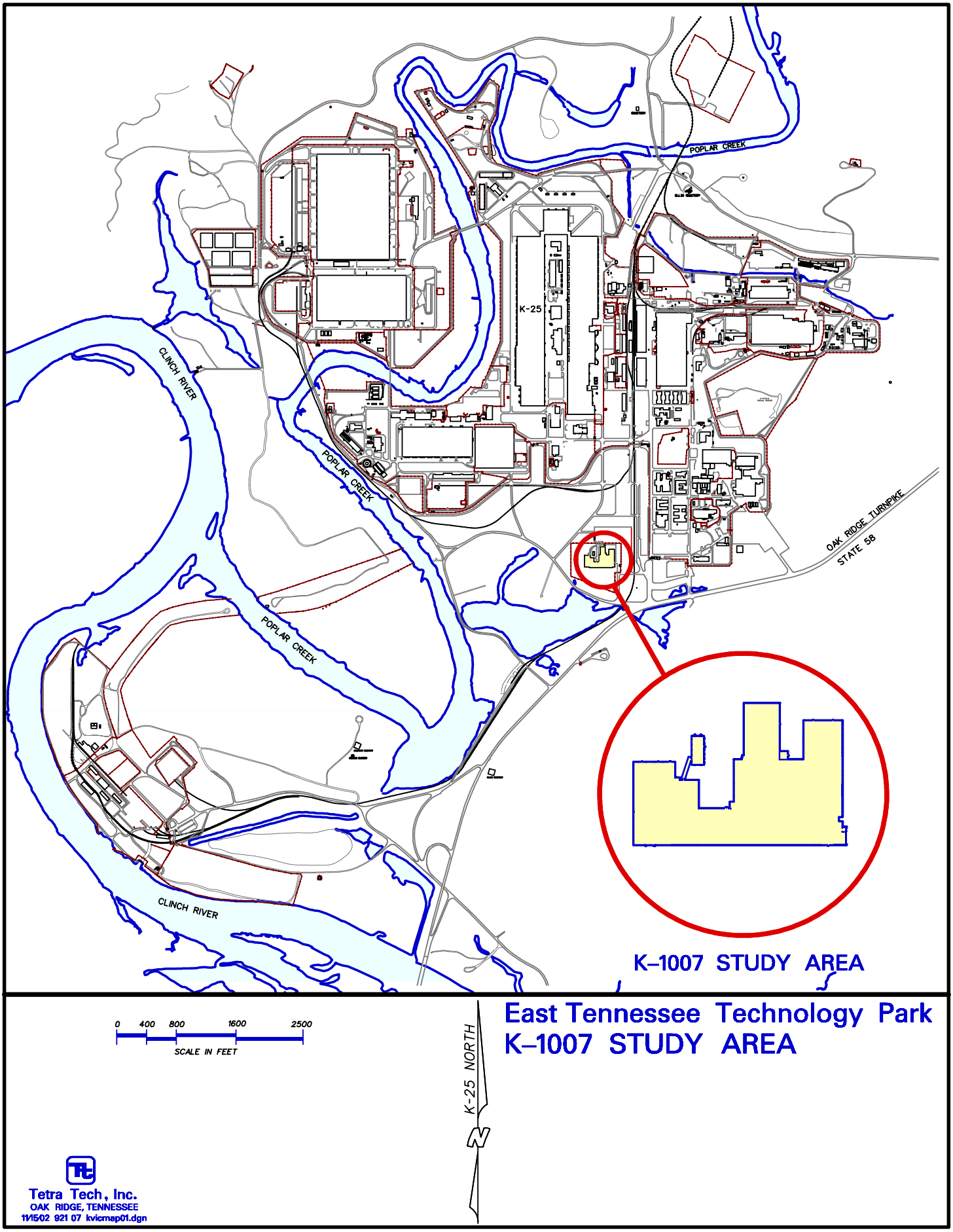

Fig. 1.1. Location map of the K-1007 study area.

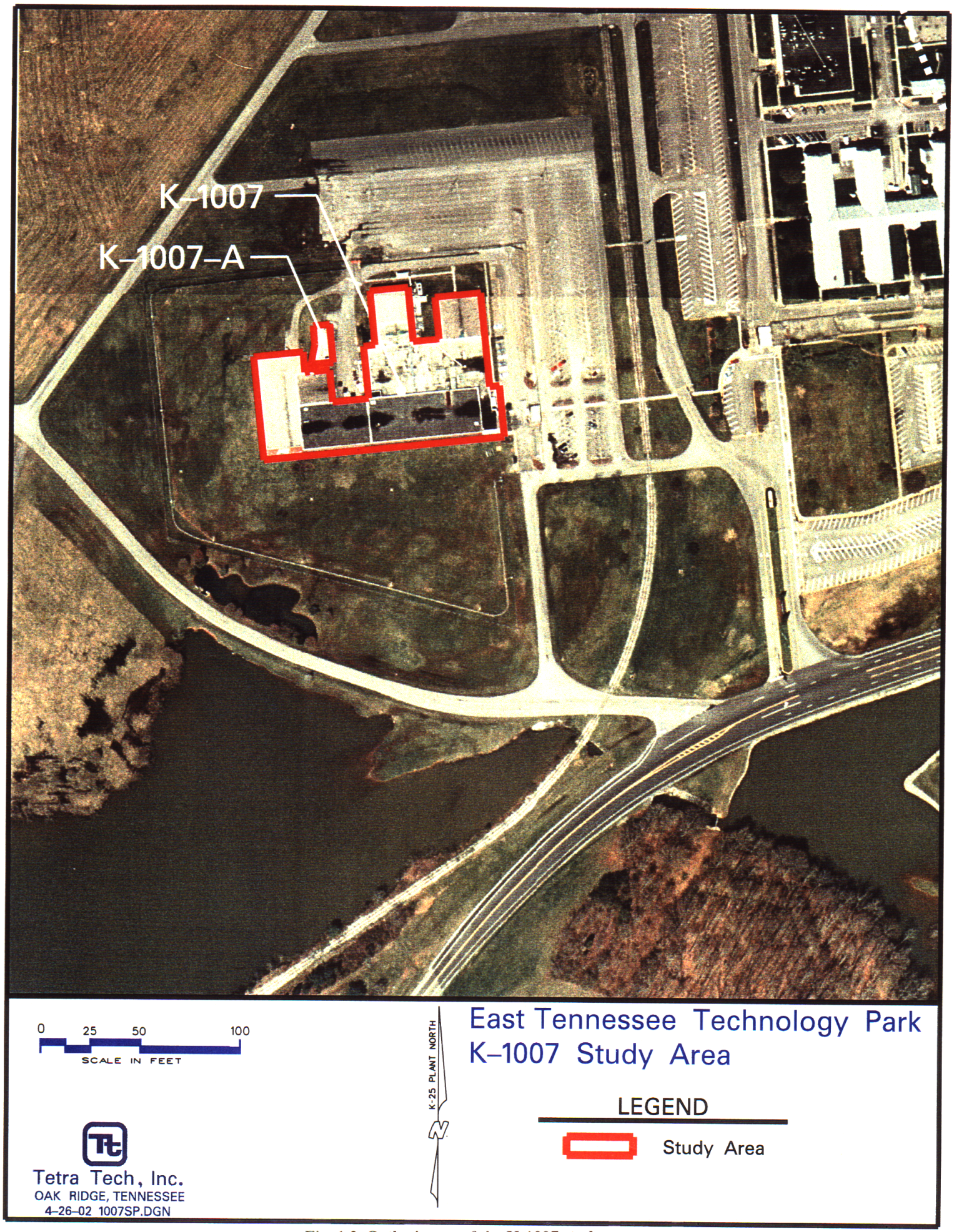

Fig. 1.2. Ortho image of the K-1007 study area.

Fig. 1.3. Aerial photograph of the K-1007 building.

2. TITLE SEARCH

On June 4, 1996, and February 27, 1997, the state of Tennessee Roane County Recorder's Office was visited and a review was conducted of the recorded deeds documenting previous ownership of the land tracts where K-1007 and nearby facilities are located. The deeds contained no information or references to other recorded evidence that the property was utilized for the storage of hazardous substances and/or petroleum products or their derivatives. Additionally, no information was contained in the deeds that indicated that hazardous substances and/or petroleum products or their derivatives were released or disposed of on the property. Prior to acquisition by the government, the area was farmland and was a combination of cultivated fields, pastures, and forested areas.

The deeds that conveyed the property from the previous owner to the U. S. Government and any deeds that conveyed the property to that previous owner were reviewed as a part of the title search. Generally, the deeds from the previous two owners of a particular ORR parcel provide information that goes back to the early 1900s or even earlier. The deeds were reviewed for any references to previous land uses (e.g., homestead, farm, school, business, etc.). Also reviewed were any easements or conveyances referenced in the deeds that might indicate that portions of the land were used for pipelines, power lines, etc. Partial disposal or acquisition conveyance deeds were also reviewed because, in some instances, the land comprising a large farm had been acquired via several separate acquisitions.

In addition, property assessment records from the County Property Assessor's Office were reviewed because these documents may also contain evidence of a particular land use. Survey or subdivision maps referenced in deeds and maintained in the Register of Deeds office were also reviewed for any indications of a previous land use. Furthermore, because the Tennessee Valley Authority (TVA) was the previous owner of several large tracts of ORR land, the TVA Real Estate Office was contacted regarding their knowledge of any previous land uses. The U. S. Army Corps of Engineers (COE) was another source of information that was contacted.

3. FEDERAL RECORDS SEARCH AND REGULATORY SUMMARY

3.1 FEDERAL RECORDS SEARCH

TVA in Knoxville, Tennessee, and the COE District Office in Nashville, Tennessee, were contacted in 1997, and again on April 6, 1998, to determine if they maintained any records reflecting past or present land use relative to the land presently comprising ETTP (TVA 1998; COE 1998). Neither TVA nor COE had any information regarding the history of past or present land use that would indicate if hazardous substances or petroleum products were stored or released on the U. S. Department of Energy (DOE)-owned property currently comprising the ETTP.

In June 1997, DOE real estate records that document previous ownership of the land tracts where K-1007 is located were examined. Page A-3 of Appendix A is a statement[3] from the Realty Officer of the DOE Oak Ridge Operations Office (ORO) that the real estate records contained no information or references to other recorded evidence that, prior to DOE ownership, the property was utilized for the storage of hazardous substances. Additionally, no information contained in these records would indicate that hazardous substances were released from or disposed of on the property.

The following pre-construction aerial photographs and maps reflecting prior use of this land were also reviewed. Copies of these photographs and maps are maintained on file in the Bechtel Jacobs Company LLC (BJC) Real Estate Office.

Aerial Photographs:

Photograph Nos. and Date	Flight By	Source
No. 130-3-9, dated 1939	Unknown	BJC, Real Estate Office
Nos. 820-2-20 through -23 and 820-3-20 through -24, dated September 25, 1942	Aero Service Corp. for Stone and Webster	BJC, Real Estate Office

These photographs, which were taken in 1939 and 1942, show that the land where the study area is located was predominantly used for agricultural purposes. The remaining land was wooded. A map depicting pre-World War II structures, churches, and cemeteries that were present in the area of ETTP is also included on page B-3 in Appendix B.

Topographic and real estate maps:

1. A November 2, 1942, topographic map identified as Sect. A-1 of ORR was prepared by Aero Services Corporation for Stone and Webster.

2. A February 19, 1945, real estate map (sheet 9 of 16) dated February 19, 1945, revised August 4, 1945, prepared by the U. S. Army, shows the boundaries of all land tracts in Segment H of the ORR that were acquired during the early 1940s for the construction of the K-25 Site. The study area is on Land Tract H-731.

[3]DOE 2002b. Statement from Realty Officer, DOE Oak Ridge Operations Office, "CERCLA 120(h) Review Lease of K-1007, East Tennessee Technology Park, Oak Ridge Reservation," June 17, 1997.

Neither the aforementioned photographs nor maps contained any information regarding the history of the past land use that would indicate that storage or releases of hazardous substances or petroleum products have occurred on the land where Land Tract H-731 is located. Copies of the 1942 topographic map and real estate map are maintained in the BJC Real Estate Office and the DOE Oak Ridge Operations Real Estate Office.

3.2 REGULATORY SUMMARY

As discussed previously, prior to ownership by DOE (and its U. S. Government predecessor agencies), the property was farmland. Any DOE operations within the footprint of K-1007 occurred under DOE's own authority, without external regulation, prior to 1984. Based on interviews with employees and a review of records, there was no evidence of releases of hazardous substances or petroleum products in excess of the substances' reportable quantities occurring in the K-1007 building. However, in 1986, there was a release of less than 100 gal of gasoline from an underground storage tank (UST) outside of the building.[4] The tank was removed along with 14 tons of contaminated soil. The excavated area was filled and covered with asphalt. This tank closure was prior to external regulation; therefore, there is no correspondence with outside regulators or a closure report. An Unusual Occurrence Report details the corrective actions taken during tank removal. This report is an appendix to the *RCRA Facility Investigation Plan K-1007 Gas Tank* (Energy Systems 1988).

Records (containing information about spills, permits, or permit violations) and interviews with employees or former employees[5] do not indicate that any regulatory actions have occurred within the footprint of K-1007. Therefore, no regulatory responses have been invoked.

Additional research is being conducted to see whether records can be found; however, any spills at or in excess of reportable quantities would have been identified in the databases and reports, but so far none has been found.

[4]Email communication from S. T. Goodpasture of CDM Federal (currently employed at ETTP and former UST manager at ETTP).

[5]Personal communications with J. R. Russell and T. A. Bowers (currently employed at ETTP).

4. PAST AND PRESENT ACTIVITIES

4.1 PAST AND PRESENT ACTIVITIES FOR THE REAL PROPERTY PROPOSED FOR TRANSFER

Prior to the acquisition of the land by the government, the entire area was farmland. Over 800 acres of land were leveled and prepared in support of the Manhattan Project (to supply enriched uranium for nuclear weapons production).

One of the areas where there was a concentration of maintenance facilities is where the present K-1007 building is located. From the 1940s through the late 1950s, this area was occupied by the K-1047 Motor Pool Repair Shop; K-1048 Tire and Battery Shop; K-1049 Repair Shop and Parts Storage; the K-1050 Wash, Grease, and Paint Shop; the Bldg. 665 Steam Shed; and the 600 Series Oil Storage Tanks. Figure 4.1 is a 1947 aerial photograph of the Oak Ridge Gaseous Diffusion Plant (ORGDP) that shows the location of these facilities and an outline that shows the location of the present K-1007 building. These facilities were demolished by the late 1950s, and the area was maintained as a grassy field until the construction of Bldg. K-1007 in 1960.

The sites of six of these former facilities, K-1048, K-1050, K-1047, 665, 600, and K-1055, are listed in Appendix C of the Federal Facility Agreement (FFA) [DOE 1992].[6] The FFA is an agreement between DOE, the U. S. Environmental Protection Agency (EPA), and the state of Tennessee to integrate the requirements of the Resource Conservation and Recovery Act of 1976 (RCRA) corrective actions and Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remedial investigations at specific sites within the ORR. The specific facilities to which the FFA applies are listed in Appendix C of the FFA. Additional detailed descriptions of these former facilities are provided in Sect. 4.2 of this report. The K-1049 Repair Shop and Parts Storage were located where the eastern section of Bldg. K-1007 is now, and the K-1048 Tire and Battery Shop was located where K-1007-A is currently located.

The original K-1007 building was built in 1960 with additions added in 1966, 1972, 1974, 1978, and 1984 to create the present facility. Since its construction, K-1007 has provided office and work space for the staff and equipment, User Services and Systems Support, and Technical Applications. Other key operations included data entry, micrographics processing, storage of electronic media, and control of production programs. A dark room on the first floor in the north end of the center wing contained specialized equipment for transferring media to microfilm and an associated silver-extracting unit. Two satellite accumulation areas were located in the adjoining room, one for the accumulation of silver and one for used fluorescent light bulbs.[7] These areas were closed in July 1998.

Portions of the building were leased to the Community Reuse Organization of East Tennessee (CROET) in 1998 as part of the Reindustrialization Program. The remainder of the building is used by DOE's prime contractor.

K-1007-A is a double-wide trailer that was added in the late 1970s as additional office space. In the early 1990s, it was converted to a canteen that contains a small kitchen and lunch/break room.

Based on records searches and interviews, a UST was located outside of Bldg. K-1007. In 1986, the UST was discovered to be leaking, and gasoline had entered the sanitary sewer lift station. The gasoline

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[6]DOE 1992. *Federal Facility Agreement for the Oak Ridge Reservation*, DOE/OR-1014, EPA Region 4, DOE, and TDEC, Washington, D.C.

[7] Personal communication with W.J. Edwards (employee or former employee at the East Tennessee Technology Park).

was removed from the lift station, and the tank was also removed along with 14 tons of contaminated soil. The tank closure was prior to external regulation; therefore, there is no correspondence with outside regulators or a closure report. However, the gasoline leak was documented in an Unusual Occurrence Report (Appendix A of K/HS-156, *RCRA Facility Investigation Plan, K-1007 Gas Tank, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee*) [Energy Systems 1988].

All observed floor drains were plugged in the early 1990s as part of the sitewide drain-plugging program. (The program was initiated to ensure that floor drains connected to the storm drain system were permanently plugged or rerouted to prevent discharge of materials into the storm drain system and to limit the potential for National Pollutant Discharge Elimination System permit non-compliances.[8]) The sources of historical information listed below were searched for additional information about any spills at K-1007. Additional research is being conducted to see if other records can be found; however, any spills at or in excess of reportable quantities would have been identified in the databases or reports, but so far none has been found.

Phase I Hazard Screening Analysis for Building K-1007 Computing and Telecommunications Center (Energy Systems 1992);

- Occurrence Reporting and Processing System (database; ORPS 2003);
- *Environmental, Health, and Safety Concerns for the New ORGDP Contractor* (Mitchell 1983);
- *Hazardous Waste Sites Historical Investigation 1987–1993* (Legeay et al. unpublished); and
- *Surveillance and Maintenance Plan for Remedial Action and Post Cleanup O&M Sites at the East Tennessee Technology Park, Oak Ridge, Tennessee* (BJC 2002b).

Background

In the early 1940s, the U. S. Government acquired the land that is presently occupied by ETTP for the construction of the ORGDP. This facility was built as part of the Manhattan Project during World War II to supply enriched uranium for nuclear weapons production. Construction of the ORGDP began in 1943, and the K-25 Building, the first gaseous diffusion enrichment facility, was fully operable by August 1945. Additional enrichment process buildings, K-27, K-29, K-31, and K-33, were completed and operable by 1956. The gaseous diffusion operations were discontinued in 1986, and in 1989, ORGDP was renamed the K-25 Site. Then in 1997, to reflect the emphasis on a regional economy fostering commercial growth for the benefit of East Tennessee, the site was renamed the "East Tennessee Technology Park."

Prior to the acquisition of the land by the government, the entire area was farmland. Over 800 acres of land were leveled and prepared to provide an area for the process buildings and their support buildings. During the construction of the process buildings, there were hundreds of temporary buildings (including warehouses, fabrication and maintenance facilities, cafeterias, housing, and offices) that provided support operations for the construction. Many of these temporary facilities have been removed over the years.

K-1007

One of the areas where there was a concentration of maintenance facilities is where the present K-1007 building is located. From the 1940s through the late 1950s, this area was occupied by the K-1047 Motor Pool Repair Shop; K-1048 Tire and Battery Shop; K-1049 Repair Shop and Parts Storage; K-1050 Wash, Grease, and Paint Shop; Building 665 Steam Shed; and 600 Series Oil Storage Tanks.

[8] Email communication from J. Murphy of CDM Federal (currently employed at ETTP).

Figure 4.1 is a 1947 aerial photograph of ORGDP that shows the location of these facilities and an outline that shows the location of the present K-1007 building. These facilities were demolished by the late 1950s, and the area was maintained as a grassy field until the construction of Bldg. K-1007 in 1960.

The sites of six of these former facilities, K-1048, K-1050, K-1047, 665, 600, and K-1055, are listed in Appendix C of the FFA (DOE 1992).[9] The FFA is an agreement between DOE, EPA, and the state of Tennessee to integrate the requirements of the RCRA corrective actions and CERCLA remedial investigations at specific sites within the ORR. The specific facilities to which the FFA applies are listed in Appendix C of the FFA. Additional detailed descriptions of these former facilities are provided in Sect. 4.2. The K-1049 Repair Shop and Parts Storage was located where the eastern section of Bldg. K-1007 is now, and the K-1048 Tire and Battery Shop was located where K-1007-A is currently located.

The original K-1007 building was built in 1960 with additions added in 1966, 1972, 1974, 1978, and 1984 to create the present facility. Since its construction in 1960, K-1007 has provided office and work space for the staff and equipment, User Services and Systems Support, and Technical Applications. Other key operations included data entry, micrographics processing, storage of electronic media, and control of production programs. A dark room on the first floor in the north end of the center wing contained specialized equipment for transferring media to microfilm and an associated silver-extracting unit. Two satellite accumulation areas were located in the adjoining room for the accumulation of mercury and used fluorescent light bulbs. These areas were closed in July 1998.

Portions of the building were leased to CROET in 1998 as part of the Reindustrialization Program. The remainder of the building is used by DOE's prime contractor.

K-1007-A Canteen

K-1007-A is a double-wide trailer that was added in the late 1970s as additional office space. In the early 1990s it was converted to a canteen that contains a small kitchen and lunch/break room.

4.2 PAST AND PRESENT ACTIVITIES – ADJACENT PROPERTY

Building K-1007 is located in the southern portion of ETTP outside the main perimeter fence. The closest non-DOE property is State Highway 58 approximately 100 yds to the south. There is no indication that activities from this non-DOE property would have contributed any contamination to the K-1007 building.

Several nearby facilities and sites of former facilities are potential areas of contamination that are in close proximity to Bldg. K-1007. These areas are listed as environmental restoration units in *Site Descriptions of the Environmental Restoration Units at the Oak Ridge K-25 Site, Oak Ridge, Tennessee*, K/ER-47/R1 (Energy Systems 1995). Report No. K/ER-47/R1 was prepared to "baseline" conditions (at the time of the evaluation), so that decisions could be made to establish cleanup priorities. These areas (from that baselining report) are also listed in Appendix C of the FFA.

1. K-1007-P1 Holding Pond – The K-1007-P1 Holding Pond is located to the south and southeast of Bldg. K-1007. It receives storm drainage and wastes from the K-1004 Area laboratory drain. Since 1985, discharges from the K-1004 Area lab drain have been limited to water and soap from the cleaning of glassware. Prior to 1985, an estimated 2200 gal of laboratory wastes were discharged through the laboratory drains to the pond. Waste chemicals included solvents, acids, bases, organics,

[9]DOE 1992. *Federal Facility Agreement for the Oak Ridge Reservation*, DOE/OR-1014, EPA Region 4, DOE, and TDEC, Washington, D.C.

Fig. 4.1. 1947 photograph of K-1007 area.

and metals. Uranium-containing solutions from the analytical laboratories were not routinely disposed of in the area lab drains. Polychlorinated biphenyl contamination has also been detected in the pond. The K-1007-P1 Holding Pond is listed as a Solid Waste Management Unit under RCRA.

2. K-1007 Gas Tank – The former K-1007 Gas Tank was a gasoline underground storage tank (UST) for the K-1007 emergency generator. It was located within the courtyard formed by the U-shape of the K-1007 building, near the K-1007-A Canteen. In 1986, the UST was discovered to be leaking and gasoline had entered the sanitary sewer lift station. The gasoline was removed from the lift station, and the tank was also removed along with 14 tons of contaminated soil. The leaking UST was removed and taken to the K-1070-C/D Burial Ground and flushed with water. It was then taken to the K-700 Area for salvage sales. The soil was transported to the K-1070-C/D Area where it was spread out on plastic to allow volatilization of the gasoline. The excavated area was filled and asphalt was placed on top. This tank closure was prior to external regulation; therefore, there is no correspondence with outside regulators or a closure report. However, there is an Unusual Occurrence Report, which details the removal and corrective actions taken. This report is an appendix to the *RCRA Facility Investigation Plan K-1007 Gas Tank* (Energy Systems 1988).

3. K-1047 Motor Pool Repair Shop – Originally designated as Bldg. 628 when it was built in 1943 or 1944, it was later re-designated as K-1047 in 1946. This building was used to service personnel carriers as a motor pool repair shop. In 1948 it was converted to a lumber warehouse. By 1958, the building had been demolished. The K-1047 building was located approximately 100 ft north of Bldg. K-1007 in the present parking lot.

4. The K-1048 Tire and Battery Shop – Building K-1048 was built in 1943 and designated as Bldg. 634. In 1946 it was re-designated as K-1048. By 1951, the shop was no longer in use, and by July 1958 the building had been demolished. The K-1048 building was located in the same location as the former K-1007 Gas Tank.

5. K-1050 Wash, Grease, and Paint Shop – This facility was originally built in 1943 and designated as Bldg. 640. It was used to wash and lubricate motorized fleet equipment to minimize undercarriage damage. By 1946, the building had been re-designated as K-1050. Work orders indicate a paint shop was included in the building. By 1960 the building had been demolished. The K-1050 building was located immediately to the north of Bldg. K-1007-A.

6. Building 665 Steam Shed – The Building 665 Steam Shed was built in 1943 as part of a six-building cleaning operation during construction of the K-27 and K-29 cascade buildings. Because of its proximity to an area of heavy and light equipment repair shops, it is believed that this operation was used to clean the undercarriages of construction vehicles that traveled the construction site. The building was demolished by 1946. The 665 building was located in the northeast corner of the parking lot north of Bldg. K-1007.

7. 600 Oil Storage Area – The 600 Oil Storage Area was located to the west of Bldg. K-1007 where Avenue "J" and Contractors Road meet. In the early 1940s, the oil storage area consisted of three aboveground oil tanks designated as 610, 612, and 614. These tanks were mounted on concrete support saddles and had an estimated capacity of 5 to 10,000 gal per tank. By 1946, the tanks had been redesignated as K-1076, K-1077, and K-1078. By 1951, the tanks had been removed. (The 600 Oil Storage Area is not shown in Fig. 4.1. It was located just out of the photograph southeast of Bldg. K-1048.)

8. K-1055 Gasoline/Diesel Station – The K-1055 Gasoline/Diesel Station was in use as early as 1944 for the construction operations for the site. One UST with dimensions of 26 ft long with a 6-ft diameter served the station. The capacities of the other tanks that may have existed are unknown. The number

and location of tanks have not been determined, nor whether or not the tanks were removed. The facility had been demolished by the 1950s. The facility closure was prior to external regulation; therefore, no correspondence with outside regulators or tank closure reports exist. The facility was located in the grassy field north of the parking lot located north of Bldg. K-1007.

Prior to 1996, there were four office trailers, K-1310-Q, -R, -CY, and -CZ located in a gravel lot on the northeast corner of K-1007 within the perimeter fence (see Fig. 1.3). Trailers K-1310-CY and -CZ were removed in late 1996. Trailers K-1310-R and -Q were removed in 1997. An additional office trailer, K-1556, was located outside the perimeter fence on the western edge of the parking lot north of Bldg. K-1007. It was removed in 2001.

4.3 HYDROGEOLOGIC ENVIRONMENT

This information is being presented to lay the basis for evaluation of potential vapor intrusion into Bldg. K-1007.

Building K-1007 is located in the southern portion of ETTP. This portion of ETTP is underlain by bedrock of the Chickamauga Supergroup. The Chickamauga Supergroup formations in this area include the Carters Limestone, Hermitage Formation, Cannon Limestone, and Catheys Formation. Due to lack of exposures, the Cannon Limestone and Catheys Formation have been mapped as one unit at ETTP. Although less prone to karst development than the Knox Group rocks in the vicinity of ETTP, the Chickamauga formations are nevertheless subject to the development of karst. Solutionally enlarged fractures, joints and bedding planes are common in exposures of Chickamauga rocks in the vicinity of ETTP. Structurally these formations have been folded into an anticline (convex upward fold) in the vicinity of the subject area with the axis of this structure located just south of K-1007. The beds generally dip northwestward on the north side of this axis and southeastward on the south side of this axis. K-1007 is located on the north side of the anticline axis (bedding dips to the northwest).

The bedrock formations underlying K-1007 generally consist of thick to massive beds of limestone with some thin to medium beds and occasional interbedded argillaceous limestone and calcareous shales. All of these formations are subject to karst development due to their high carbonate content. Evidence of karst development in the Chickamauga includes cavities encountered in drilling at ETTP. Approximately thirty percent of the monitoring wells completed in the Chickamauga at ETTP encountered cavities ranging in size from a few inches up to 7 ft. In addition, pre-construction topographic maps indicate the occurrence of sinkholes west of Building K-1007. These sinkholes were filled during construction of the plant in the 1940s.

Four unconsolidated zone monitoring wells (UNW-047, located north of K-1007, and UNW-070, UNW-071, and UNW-072, located south of K-1007) and three bedrock wells (BRW-036, BRW-042, and BRW-043, all located north of K-1007) have been installed in the vicinity of Building K-1007. The hydrogeologic characterization data presented below for K-1007 are based on the data from these wells.

Depth to bedrock and depth to groundwater beneath K-1007 can be determined from the wells drilled in the vicinity of the building. In addition, site-specific data for hydraulic conductivity and hydraulic gradient can also be determined. Based on data from these wells, depth to bedrock ranges from 4 to 16 ft below ground surface (bgs). Fill material at Bldg. K-1007 appears to be limited to that used only for site grading activities during construction. The depth to groundwater at K-1007 ranges from 4 to 10 ft bgs in the vicinity of the building. The depth to water becomes shallower moving from north-northeast to south-southwest in the vicinity of the building. Shallow groundwater flow is to the south-southwest at K-1007. Based on data from slug tests conducted in the wells completed in the vicinity of K-1007, hydraulic conductivity has

been determined for the Chickamauga bedrock and the overburden materials. These data are summarized in Table 4.1 in addition to other hydrogeologic characterization parameters for K-1007.

Table 4.1. Summary of hydrogeologic conditions at K-1007

Parameter	Site conditions
Is a groundwater plume present beneath the site?	None identified
Distance from site to nearest upgradient plume (ft)	1000
Is karst present?	Yes
Depth to bedrock (ft)	4–16[a]
Depth to groundwater (ft)	4–10[a]
Are fill materials present at the site?	Minimal
Composition of overburden materials present.	Silty clay[a]
Shallow groundwater flow direction	S–SW
Hydraulic conductivity of overburden materials (cm/s)	8.9E-06[b]
Hydraulic conductivity of bedrock (cm/s)	4.02E-05[c]
Hydraulic gradient at the site (ft/ft)	0.0083[a]
Is a perched water table present at the site?	None identified

[a]Represents interpolated value based available data.

[b]Represents average hydraulic conductivity of unconsolidated zone at ETTP based on slug tests of wells completed in Chickamauga bedrock.

[c]Represents average hydraulic conductivity of bedrock at East Tennessee Technology Park (ETTP) based on slug tests of wells completed in overburden developed above Chickamauga bedrock.

Groundwater samples have been collected from both unconsolidated zone and bedrock wells in the vicinity of Building K-1007 (Fig. 4.2) since 1994. Monitoring wells UNW-047, BRW-036, BRW-042, and BRW-043 have been sampled five times from 1994 to 1998. Monitoring wells UNW-070, UNW-071, and UNW-072 have been sampled ten times between the years 1994 and 2000. Groundwater samples collected from these wells have indicated the sporadic occurrence of low, estimated concentrations of trichloroethene (TCE) and other volatile organic compounds (see Tables 4.2 and 4.3). TCE has been detected at UNW-047, UNW-071, and UNW-072 at concentrations ranging from an estimated concentration of 1 μg/L to 14 μg/L. Only the September 1997 sample at UNW-071 (14 μg/L) and the September 1995 sample at UNW-072 (8 μg/L) exceeded the Primary Drinking Water Standard maximum contaminant level (MCL) for TCE of 5 μg/L. Trichloroethene has also been detected in bedrock wells BRW-042 and BRW-043 at concentrations ranging from an estimated concentration of 1 μg/L to 15 μg/L. Only the October 1994 sample at BRW-042 (15 μg/L) exceeded the MCL of 5 μg/L for TCE. In addition to TCE; 1,1,1-trichloroethane; 1,1-dichloroethane; 1,1-dichloroethene; 1,2-dichloroethene; 2-butanone; acetone; methylene chloride; and tetrachloroethene have been reported during at least one sampling event at the unconsolidated zone wells located in the vicinity of K-1007. However, in general, these compounds have not been detected in the most recent sampling events at these wells. The compounds 1,2-dichloroethene; acetone; tetrachloroethene; and toluene have been reported, in addition to TCE, during at least one sampling event at the bedrock wells located adjacent to K-1007. Only TCE at wells BRW-042 and BRW-043 has been detected in the most recent sampling events at the bedrock wells. The source of these compounds in these wells is currently undetermined.

Concentrations of VOCs in a groundwater plume from an identified source nearest to, and upgradient of K-1007, which is located approximately 1,000 ft to the northeast of K-1007 (Fig. 4.2), are similar to those reported for monitoring wells adjacent to the building. The concentrations of TCE, which is the primary VOC in the nearest plume, at the leading edge of the plume range from nondetect to 20 μg/L, concentrations of 1,2-dichloroethene range from nondetect to 7 μg/L, and concentrations of tetrachloroethene

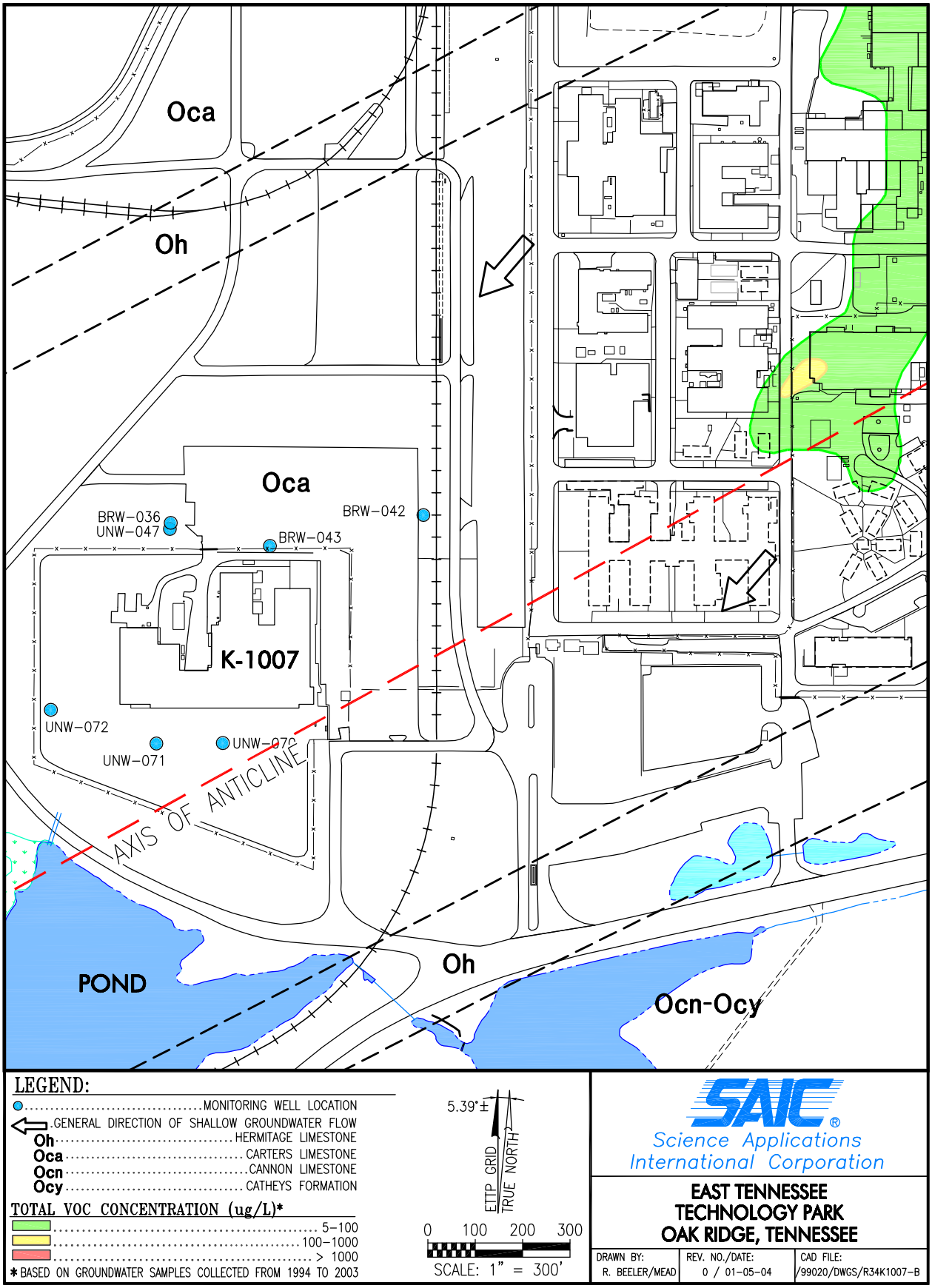

Fig. 4.2. Groundwater VOC concentrations in the vicinity of K-1007.

Table 4.2. Summary of VOCs detected in groundwater samples from unconsolidated zone monitoring wells in the vicinity of K-1007

Analyte (µg/L)	MCL	UNW-047					UNW-070									
		10-94	2-95	9-95	6-98	7-98	10-94	3-95	9-95	9-97	2-98	8-98	4-99	9-99	2-00	8-00
1,1,1-Trichloroethane	200	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
1,1-Dichloroethane	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
1,1-Dichloroethene	7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
1,2-Dichloroethene	70[a]	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	2 U	2 U
2-butanone	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	4 J	50 U	50 U
Acetone	NA	10 U	10 U	10 U	10 U	10 U	14 J	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	50 U	50 U
Methylene chloride	5	5 U	5 U	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	2 U	2 U
Tetrachloroethene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
Trichloroethene	5	2 J	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U

Analyte (µg/L)	MCL	UNW-071									
		10-94	3-95	9-95	9-97	2-98	8-98	4-99	9-99	2-00	8-00
1,1,1-Trichloroethane	200	5 U	5 U	5 U	19	5 U	5 U	5 U	5 U	2 U	2 U
1,1-Dichloroethane	NA	5 U	5 U	5 U	5 J	5 U	5 U	5 U	5 U	2 U	2 U
1,1-Dichloroethene	7	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	2 U	2 U
1,2-Dichloroethene	70[a]	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
2-butanone	NA	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	50 U	50 U
Acetone	NA	10 U	10 UJ	11 U	10 U	15 U	10 U	10 U	3 J	50 U	50 U
Methylene chloride	5	2 J	5 U	5 U	5 U	11 U	5 U	8 U	2 J	2 U	2 U
Tetrachloroethene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
Trichloroethene	5	5 U	5 J	5 U	**14**	5 U	5 U	5 U	5 U	2 U	2 U

Analyte (µg/L)	MCL	UNW-072									
		10-94	3-95	9-95	9-97	2-98	7-98	4-99	9-99	2-00	8-00
1,1,1-Trichloroethane	200	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
1,1-Dichloroethane	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
1,1-Dichloroethene	7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
1,2-Dichloroethene	70[a]	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	2 U	2 U
2-butanone	NA	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	50 U	50 U
Acetone	NA	60 J	10 UJ	16 U	10 U	10 U	10 U	10 U	10 U	50 U	50 U
Methylene chloride	5	5 U	5 U	5 U	5 U	7 U	8 U	5 U	2 J	2 U	2 U
Tetrachloroethene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U	2 U
Trichloroethene	5	5 U	5 U	**8**	5 U	5 U	1 J	5 U	5 U	2 U	2 U

[a]Represents MCL for the cis-1,2-dichloroethene isomer.
Bold indicates the concentration exceeds the MCL.
MCL = maximum contaminant level.
NA = not available.
J = estimated concentration.
U = analyte not detected at indicated concentration.
UJ = not detected but the value represents an estimated concentration.

Table 4.3. Summary of VOCs detected in groundwater samples from bedrock monitoring wells in the vicinity of K-1007

		BRW-036					BRW-042					BRW-043				
Analyte (µg/L)	MCL	10-94	3-95	9-95	5-98	7-98	10-94	3-95	9-95	6-98	7-98	10-94	3-95	9-95	6-98	7-98
1,2-Dichloroethene	70[a]	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	34 J	10 U	10 U	10 U	10 U
Tetrachloroethene	5	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	1000	5 U	5 U	4 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5	5 U	5 U	5 U	5 U	5 U	15	2 J	5 U	4 J	2 J	5 U	5 U	5 U	1 J	5 U

[a]Represents MCL for the cis-1,2-dichloroethene isomer.
MCL = maximum contaminant level.
NA = not available.
J = estimated concentration.
U = analyte not detected at indicated concentration.

range from nondetect to 13 μg/L. These VOC concentrations have remained relatively steady over the sampling period of record for the wells in this plume. Given the distance from K-1007 to the nearest upgradient groundwater plume (~1000 ft) and the natural attenuation processes that would affect VOC concentrations in this plume, it appears likely that any potential future VOC concentrations at K-1007 would not exceed reported historical concentrations (see Tables 4.2 and 4.3). The historical maximum concentration of TCE is 14 μg/L reported for monitoring well UNW-071. This well has also contained the maximum 1,1,1-trichloroethene (19 μg/L); 1,1-dichloroethane (5 μg/L); and 1,1-dichloroethene (2 μg/L) concentrations.

4.4 EVALUATION OF POTENTIAL VAPOR INTRUSION EXPOSURE PATHWAY

EPA issued the *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Draft Vapor Intrusion Guidance)*, EPA530-F-052, in November 2002. This guidance is intended to help determine if the vapor intrusion exposure pathway poses a significant risk to human health. Vapor intrusion is the migration of VOCs in contaminated groundwater and/or soil to indoor air. According to the Draft Vapor Intrusion Guidance, in extreme cases, the vapors may accumulate in occupied buildings to levels that may pose safety hazards and/or health effects. Typically, however, the chemical concentration levels are low or, depending on site-specific conditions, vapors may not be present at detectable concentrations. Generally, the Draft Vapor Intrusion Guidance is intended for residential settings and does not apply to occupational settings. However, due to the occurrence of VOCs in shallow groundwater in some areas at ETTP and because a Covenant Deferral approach under CERCLA Sect. 120(h) will be used to support the transfers, EPA Region 4 recommended investigation of the vapor intrusion pathway for facilities at the ETTP that are targeted for transfer to CROET or other qualified parties.

In accordance with the Draft Vapor Intrusion Guidance, and through consultation with representatives from EPA Region 4, DOE Oak Ridge Operations (ORO) has developed a process to evaluate the potential for vapor intrusion at existing ETTP facilities to be transferred to the private sector under a CERCLA Sect. 120(h) Covenant Deferral Request (CDR). The following outlines that process with a focus on the first group of buildings scheduled for transfer to CROET in May 2004. This first group consists of five office buildings designated as K-1007, K-1225, K-1330, K-1400, and K-1580. Two of these buildings (i.e., K-1400 and K-1225) are located within 100 ft of a VOC-contaminated groundwater plume, while the other three (K-1007, K-1330, and K-1580) are not in close proximity (more than 100 ft) and generally down or side gradient from a plume.

ORO, EPA Region 4, and TDEC agree that vapor intrusion will be addressed in the ETTP site-wide groundwater Record of Decision (ROD). The groundwater ROD is scheduled to be signed by 2006. Until that time, ORO will take the following actions to ensure that transfer of these buildings is protective of human health.

1. ORO will collect building sub-slab soil-vapor samples in these five buildings and will proceed as follows:

   a. EPA will review the soil-vapor sampling plans prior to implementation (see Appendix C).

   b. Samples will be collected during the winter months prior to transfer.

   c. Individual sample results will be compared to pre-established trigger levels for soil vapor that will be developed using a Hazard Index of 0.1 and a risk value of 10^{-5}.

d. If the soil vapor analytical results are below the trigger levels, then no further action in the building will be necessary unless site (i.e., groundwater) or building conditions change (see below for further details).

e. If air samples are collected, the results will be compared to the 25-year industrial preliminary remediation goals (PRGs). If the results yield unacceptable risks (i.e., the PRGs are exceeded), the vapor intrusion pathway will be considered complete and ORO will consult with the transferee (e.g., CROET) to determine if they are still interested in transfer of the building. If the transferee desires the building, it will be retrofitted as necessary to eliminate or reduce the risk to acceptable levels, and confirmatory sampling will be conducted.

f. If the indoor air samples do not result in an unacceptable risk (i.e., the PRGs are not exceeded), the building will be transferred, and annual indoor air sampling will be conducted to ensure that the vapor intrusion pathway has not become complete due to any changed conditions in the integrity of the building structure.

g. ORO will conduct a follow-up sub-slab sampling event for these five buildings in the summer of 2004 to confirm protectiveness after transfer. The same process will be followed as described above. If the results of the evaluation indicate that vapor intrusion poses an unacceptable risk to human health, ORO will take the necessary actions to ensure protectiveness.

h. After the follow-up summer sampling, and in accordance with CERCLA, together with EPA's Draft Vapor Intrusion guidance, and/or other appropriate EPA guidance, re-evaluation of the vapor intrusion pathway will be conducted only if site conditions (i.e. groundwater) and/or building use changes. The ETTP site-specific groundwater data (gathered over the past 10+ years) show stable conditions and a decreasing trend in VOC concentrations. As part of a site-wide groundwater monitoring program, ORO collects samples on an annual basis. Data from the annual monitoring will be used to determine if site conditions change. Specifically, a sample from the active groundwater monitoring well nearest to the building being evaluated and downgradient from the nearest plume will be collected annually. If more than one active well exists, then the one with the highest average concentration of TCE will be used for sampling. An initial sample from this well will be collected to establish current conditions. In the absence of a suitable well nearby to accurately monitor the groundwater conditions, the FFA parties will determine the best approach to evaluate changes. *(The specific manner in which groundwater data will be used to monitor the stability of site conditions is still being negotiated between ORO and EPA Region 4 and negotiations are expected to close on February 2004, after additional information on the DOE proposed approach is provided to EPA and before the final CDR is submitted for EPA approval.)* If the groundwater conditions change in a way that might create an unacceptable risk of exposure through the vapor intrusion pathway, ORO will conduct a re-evaluation of the building. Additionally, comprehensive changes to the building structure of infrastructure (e.g., replacement of the heating ventilation and air conditioning system) that have the potential to alter previous conclusions may require re-evaluation. If such changes are made, the transferee (i.e., CROET) will notify DOE and, if necessary, DOE will re-evaluate to ensure that the pre-transfer determination has not changed. If the results of the re-evaluation indicate that vapor intrusion poses a significant risk to human health, ORO will take necessary actions to ensure protectiveness. It should be noted that the buildings will continue to be used for occupational purposes in accordance with deed restrictions.

i. A re-evaluation will consist of additional soil-vapor sampling and, if necessary, indoor-air sampling. If the results of the re-evaluation indicate that vapor intrusion poses a significant risk to human health, ORO will take necessary actions to ensure protectiveness.

2. The transfer process for these facilities will proceed concurrent with the process laid out above. EPA's approval of the CDR will be pending until completion of the first sampling activity (i.e., winter) and evaluation of the data to ensure protectiveness.

3. The CDR package will be issued for the required 30-day public comment period prior to completion of the winter sampling. The data from this sampling, as well as the data collected in the summer, will be made available to the public by posting them on a web site. When the data are posted, announcements will be made regarding their available.

5. RESULTS OF VISUAL AND PHYSICAL INSPECTIONS

5.1 VISUAL AND PHYSICAL INSPECTIONS OF THE PROPERTY FOR TRANSFER

In May 2002, a walkdown of the K-1007 building was conducted by two representatives from Science Applications International Corporation and two representatives of BJC to observe the environmental conditions of the building. This chapter documents the observations of the May 2002 inspection.

The original K-1007 structure was built in 1960 and is a reinforced concrete building on a concrete slab foundation. The building was expanded through the years to include a two-story west addition and several one-story additions on the north side. The two-story addition is steel framed with steel bar joists while the one-story additions are pre-cast channel roof slabs supported by exterior concrete masonry walls.

Figures 5.1 and 5.2 show the floor plans of the first and second floors, respectively. On the first floor on the east side of the building, there is a large equipment room (Room 1003 in Fig. 5.1). This room is currently being used to store modular office furniture. The room has raised floors to allow space for the electrical cables, air-conditioning ducts, and the inoperable Halon 1301 Fire Suppression system. (The Halogen canisters for the fire extinguishing system have been removed and the system is inactive.) The clearance under these floors varies from 6 to 14 in. Several different types of film and microfiche processing occurred in this room over the years. In 1997, the last of the micrograph machines for processing microfiche and a silver-extracting unit were removed. The silver-extracting unit was used in the black and white processing. Several different silver-extracting units were in use over the years. Black and white processing ceased between 1995 and 1996. The fixers were run through the extracting unit and then were disposed of via the drain (which was connected to the sanitary sewer system). The color developers used in the microfiche system were picked up by waste management beginning in the mid-1980s. A listing of the agents used in the black and white and color processing can be found in Table 5.1. This work was done in a raised-floor area and, based on interviews, incidental drips and minor spills of developers and fixers did take place, but no formal documentation was found.[10] Some of these spills may have leaked (if not cleaned up in time) to the concrete floor below. No silver releases have been documented.

Table 5.1. Types of fixers, developers, and rinses used in processing

Color	Black and white
AUTOCOM chem. Kit, developer, Wash I, Wash II, Fixer	ALTA ANACOMP Auto D2 Developer
FUJU 202 COM-Pak negative developers, fixer, and rinses	ALTA Photographic Auto F2 Fixer
FUJU 202-1 and 2020-2 COM-Pak negative developers	ALTA ANACOMP First wash
FUJI 202-4 COM-Pak negative first rinse	ALTA ANACOMP Second wash
FIJU 202-5 COM-Pak negative final rinse	
KODAK VNF-1/RVNP Color developer replenisher, Part A and Part B	
KODAK VNF-1/RVNP color developer replenisher, Part A	
KODAK Liquid developer system cleaner	
KODAK Dacomatic DR-5 Bleach and replenisher	

For detailed information about the products listed here, consult the Material Safety Data Sheets (MSDSs). MSDSs are available at several free websites, including http://msdssolutions.com/index.asp or http://www.setonresourcecenter.com/MSDS/index.htm.

Several of the larger rooms are being used to stage modular furniture being removed from the building. The rest of the first floor contains offices, storage rooms, conference rooms, rest rooms, a switchgear room, electrical distribution rooms, and a mechanical equipment room. All floor drains have been plugged and

[10] Email communication from W. J. Edwards (employee or former employee at the East Tennessee Technology Park).

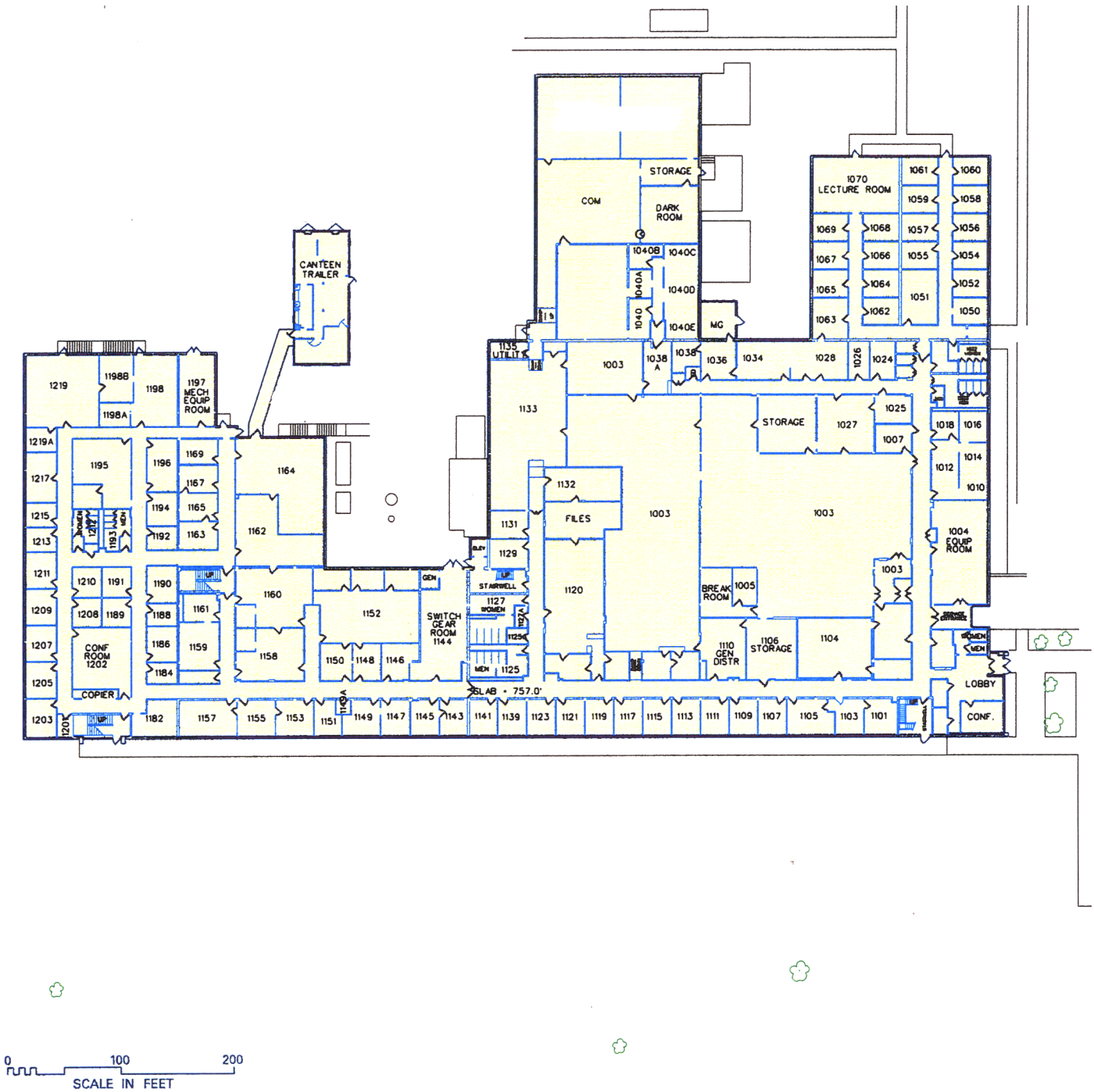

Fig. 5.1. K-1007 first floor plan.

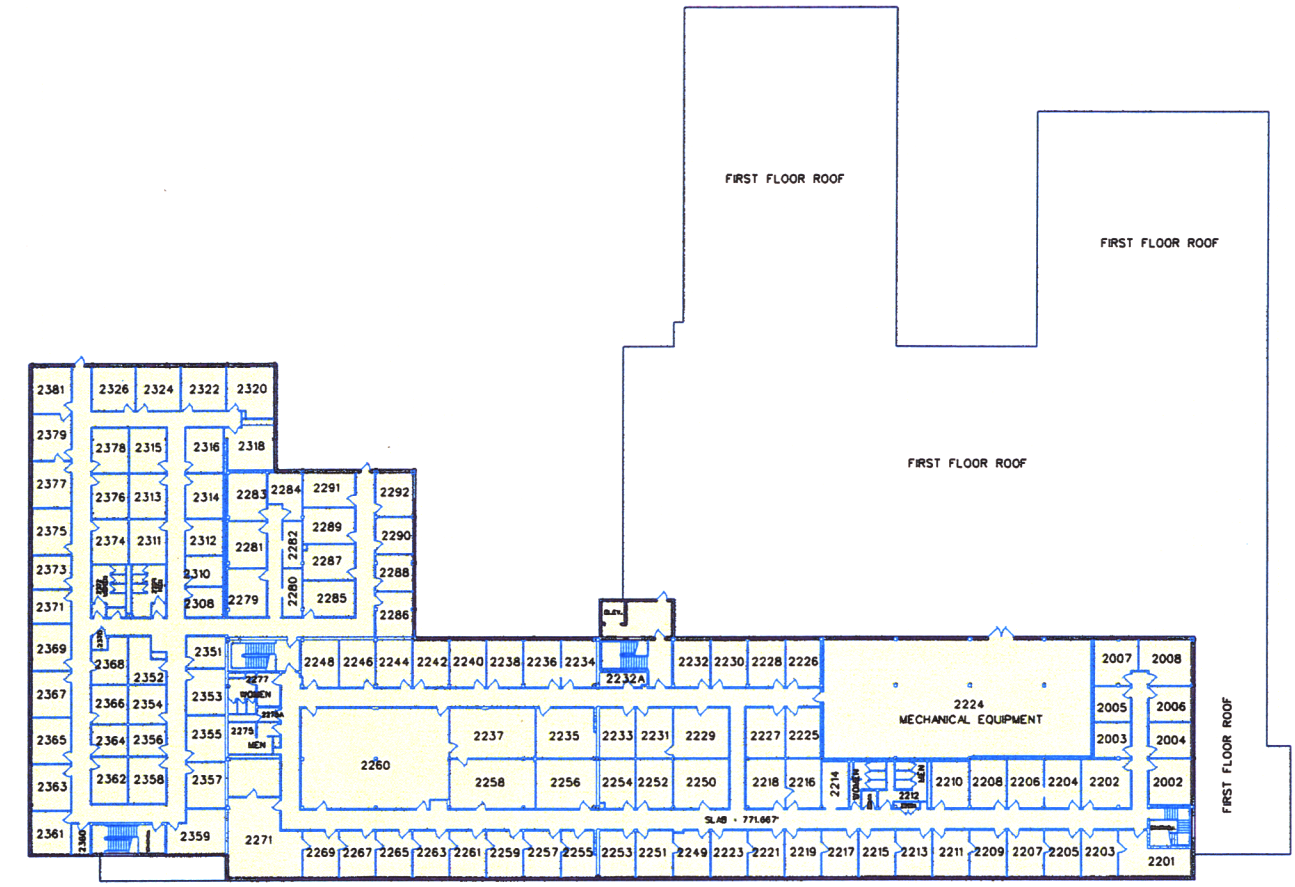

Fig. 5.2. K-1007 second floor plan.

there are no discharges to storm drains. The drains were plugged as part of the sitewide drain-plugging effort between 1990 and 1991 and were never sampled. The drains are the typical office/bathroom drains and can be sampled if needed.

The switchgear room (Room 1144) is located in the center of the facility's ground floor and contains transformers, switchgear, wet-cell batteries, and a gasoline-powered generator. Electricity for the building enters in this room through the transformers where the voltage is reduced and distributed to smaller transformers throughout the building for further distribution. The system transformers (13,800 volts/480 volts) are dry-type (no oil) transformers. The 480-volt switch breakers interrupt the system using air.[11] There are eight wet-cell batteries that are used to provide power to alarms, the emergency public address system, and emergency lighting in the event of a power outage. Each battery contains approximately 1 gal of sulfuric acid. The gasoline generator is not operational and is in standby condition since the source of fuel was removed in 1986 (see Sect. 4.2 for a discussion of UST removal).

The mechanical room (Room 1197) is located in the northwest portion of the building and contains a compressor for the heating and ventilating equipment that serves that section of the building. It is connected to a chiller unit on the outside of the building. An abandoned heat exchanger and associated equipment are also in the room.

The second floor contains additional office space, conference rooms, restrooms, electrical distribution rooms, and a mechanical equipment room. The mechanical equipment room (Room 2224) is located in the east end of the floor. It contains compressors, air handling equipment, heat exchangers, and a hot water heater. This is the main distribution room for heating, ventilating, and air-conditioning for the building. There are large heat exchangers and air handling equipment that are connected to chillers located on the roof. The room also contains abandoned compressors and piping from older equipment. The numerous heating and ventilating units used to heat and cool Bldg. K-1007 operate using steam for heat and chilled water for cooling. The chilled water contains ethylene glycol as antifreeze with an ethylene glycol-to-water ratio of one to three. Asbestos- and non-asbestos-containing materials are used in the insulation for the steam and chilled water piping throughout the building. The observed asbestos insulation appeared to be in good condition.

Access to certain areas of K-1007 is controlled by badge readers to prevent entry by unauthorized personnel. There are other exits for emergency use, but not for access to the building. An elevator is located near the stairs in the center of the building.

There are several flammable storage cabinets in the building that, in the past, were used for storing lubrication oils and cleaning solutions. These materials have been removed and all observed cabinets were empty except for a cabinet that contained a 1-gal container of anti-static liquid. The janitorial closets contain standard cleaning supplies and are labeled as hazardous material storage areas. The lubrication oils stored in the flammable storage cabinets did not contain polychlorinated biphenyls (PCBs).

Lighting throughout the building is by fluorescent fixtures, which have ballasts that may contain PCBs. Most of the emergency lighting is provided by older model emergency lights that have lead-acid batteries. These are found in all the hallways of the building. The major portion of the floors in Bldg. K-1007 are covered with vinyl floor tile. Scattered throughout the building are a few broken or missing tiles, particularly in the first floor switchgear room and the K-1007-A Canteen. The remainder appear to be in good condition. Since samples were not taken, all vinyl floor tiles are considered to contain asbestos. Reference asbestos letter that has been added to the reference section. The rest rooms have clay ceramic tile floors.

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[11] Email communication from J. D. Lovette (currently employed at ETTP).

Due to the age of K-1007, it is assumed that lead-based paint has been used extensively throughout the building. No sampling was conducted to confirm this. There is also the potential of mercury to be present in some of the auxiliary Gamewell fire alarm boxes.

There are several pieces of ancillary equipment located on the exterior of K-1007 that support the operation of the building and will be included in the title transfer. This equipment includes chillers, air-conditioning units, and electrical transformers. Each is mounted on a concrete pad with associated conduits and insulated piping connected to the building. The transformers are the dry type and contain no oil. The chillers cool the glycol mixture and return it to the heat exchangers in the building to support the ventilation system.

A lunchroom, K-1007-A, is a doublewide trailer that is attached by an enclosed walkway to the main building. It contains vending machines, microwave ovens, and tables. The fluorescent lighting may have ballasts that contain PCBs. The floors are covered with vinyl floor tile, which is presumed to contain asbestos. Several of the tiles were broken.

5.2 VISUAL AND PHYSICAL INSPECTION OF ADJACENT PROPERTY

The adjacent areas are owned by DOE and have been assessed to determine actual or potential releases of hazardous substances or petroleum products. Information about each of the adjacent areas that may contain contamination is documented in Sect. 4.2.

Two large asphalt parking lots are located on the north and east sides of K-1007. The entire K-1007 building and a large grassy buffer area to the west, north, and south are enclosed with a 7-ft-high, chain-link fence topped with barbed wire. This fence was used as a security fence for the building through the 1990s. Sections of the fence have been removed. The parking lots are not fenced. Across Contractors Road to the west is the K-1007-P1 Holding Pond. The pond's water level is held relatively constant by a weir dam at the west end of the pond on Burchfield Road. Located on a peninsula on the north side of the pond are the K-1209 Meteorological Tower and the K-1209-A Thunderstorm Indicator. These structures are used by the park shift superintendent during emergencies and inclement weather to aid in the protection of park personnel.

There is one smaller building to the east of K-1007. This is Bldg. K-1028-70, the former Portal 1A. Building K-1028-70 was originally built as the security portal (Portal 1A) that provided access to the K-1007 complex. It is a brick structure, approximately 30 ft by 30 ft, located to the east of the main entrance of Bldg. K-1007. When badge readers were placed on the main entrances of K-1007, the need for a manned guard post was eliminated and the portal was converted to an office. It has a storage closet and restroom.

6. SAMPLING RESULTS

6.1 DESCRIPTION OF BUILDING K-1007

The area proposed for title transfer includes the K-1007 building, K-1007-A trailer, and underlying fee. Therefore, the areas surveyed include the K-1007 building (interior and exterior surfaces) and the K-1007-A canteen trailer. No exterior laydown, parking, or soil areas are associated with the proposed title transfer footprint. The K-1007 building has been primarily used for office space and systems support and has two floors (72,413 ft^2 on the 1st floor and 39,703 ft^2 on the 2nd floor). The K-1007-A canteen trailer has been used as a lunchroom and is 1344 ft^2 in size, not including the covered walkway from K-1007 to K-1007-A.

6.2 CHEMICAL AND RADIOLOGICAL SAMPLING

Based on discussions with EPA, it has been agreed that the need to collect soil samples to support title transfer activities will be determined on a case-by-case basis. Factors, such as a facility's past operational history and geographic location, will be considered. In addition, the history and knowledge of activities at adjacent properties are evaluated.

Document reviews of the K-1007 property and adjacent areas indicate that there are areas of potential concern related to operations that took place from 1944 through 1957. Information was gathered on these facilities from previously published reports, including site historical investigations, and the K-25 Site Access and K-25 Site Decontamination and Decommissioning Facility databases, and compiled into the *Site Descriptions of Environmental Restoration Units at the Oak Ridge K-25 Site* (Energy Systems 1995) document previously discussed in Sect. 4.2. These former facilities included the K-1050 Wash, Grease, and Paint Shop; K-1047 Motor Pool Repair Shop; K-1048 Tire and Battery Shop; K-1049 Repair Shop and Parts Storage; K-1055 Gasoline/Diesel Station; and K-1007 Gas Tank (see Fig. 4.1 for locations).

6.2.1 Former Facilities Within the K-1007 Footprint

Only one former facility, the K-1049 Repair Shop and Parts Storage, lies directly below the K-1007 footprint. This facility is not listed in *Site Descriptions of Environmental Restoration Units at the Oak Ridge K-25 Site* (Energy Systems 1995) as an environmental restoration unit in the Environmental Restoration Program, or in Appendix C of the FFA as an area of concern. Based on the fact that this site is not listed in these two documents, one can conclude that further investigation is not necessary. After the building was demolished in the late 1950s, the area was graded and maintained as a grassy field until K-1007 was constructed in 1960. For these reasons DOE does not propose any sampling of the underlying fee.

6.2.2 Former Facilities Adjacent to the K-1007 Footprint

The former facilities that are in areas adjacent to K-1007, but not in the underlying fee, are the K-1050 Wash, Grease, and Paint Shop; K-1047 Motor Pool Repair Shop; K-1048 Tire and Battery Shop; K-1055 Gasoline/Diesel Station; and K-1007 Gas Tank (discussed in Sect. 4.2 and shown in Fig. 4.1). The K-1048 facility and the K-1007 Gas Tank were located within the courtyard formed by the U-shape of the K-1007 building. K-1047 was located approximately 100 ft north of the east wing of K-1007, and K-1055 was located approximately 100 ft north of K-1047. The K-1050 facility was located in the vicinity of the K-1007-A Canteen. The activities in these facilities have been identified as potential sources of contamination of the area and, therefore, are listed in the FFA for further characterization and evaluation (historical sampling is discussed below). The title transfer of K-1007 will not impact further investigations of these areas.

6.2.2.1 Historical sampling in the K-1007 area

In the mid-1990s, a site remedial investigation (RI)[12] for ETTP was conducted that included subsurface soil and groundwater samples from the K-1007 area. The subsurface soil samples were collected from four borings at K-1050, three borings at K-1047, two borings at K-1048, and one boring at K-1055. Seven groundwater wells (three bedrock and four unconsolidated zone monitoring wells) were placed around K-1007. A baseline human health risk assessment was conducted on the RI results that included four different land use scenarios, including controlled industrial workers (exposed to surface soil only); uncontrolled industrial workers (exposed to surface and subsurface soils, sediments, and groundwater for drinking only at 1 L/d); residential occupants (exposed to surface and subsurface soils, sediments, groundwater for drinking at 2 L/d, dermal contact-inhalation of VOCs for household use, and surface water); and recreational users (exposed to surface soils, sediments, and surface water only).

Evaluation of the soil data shows that the human health risks in soils were within the acceptable range. Evaluation of the groundwater data indicates that there is an aggregated risk outside EPA acceptable risk range under the residential scenario use; the risk is 1.2E-04[13]. The contaminants of concern (COCs) are beryllium, bis(2-ethylhexyl)phthalate, and di-*n*-octylphthalate. Bis(2-ethylhexyl)phthalate is ubiquitous in groundwater at ETTP. Note that none of the COCs are VOCs. Because the monitoring wells are downgradient of the facilities, it is not possible to differentiate which locations are responsible for the observed contaminants.

Even though the beryllium, di-*n*-phthalate, and bis(2-ethylhexyl)phthalate cannot be excluded as COCs, there is minimal opportunity for human exposure due to the groundwater restrictions that are placed in the transfer documents. Any potential risk that a future occupant may be exposed to is evaluated in *Risk Screen to Support the Title Transfer of the K-1007 Building at the East Tennessee Technology Park, Oak Ridge, Tennessee*, BJC/OR-1291 (BJC 2004).

6.3 RADIOLOGICAL SURVEYS

This section presents and discusses the radiological survey data that have been collected and reported in ETTP/PEM-0205, *Radiological Survey Report for the Transfer of the K-1007 Building and K-1007-A Trailer at the East Tennessee Technology Park, Oak Ridge, Tennessee, to the Community Reuse Organization of East Tennessee* (BJC 2002c). A discussion of the historical survey data is presented (Sect. 6.3.1), followed by a discussion of the current survey plan, results, and quality control/assurance of the data (Sect. 6.3.2). The final subsection (Sect. 6.3.3) presents a summary of the data review and results of the statistical analysis of the survey data set for the area.

Radiological contamination, if present, was expected to be a small percentage of the DOE surface contamination limits due to the results of the prior surveys performed in the area. These results are discussed below.

Process history of the ETTP site indicates that uranium (natural, depleted, and/or enriched uranium) would be the most prominent radiological contaminant potentially present in the K-1007 building due to tracking of contamination from other on-site buildings. Uranium-235 enrichment levels expected from operations since the early 1960s would be anticipated to be between 0.2 to 5.0%. Most facilities would be potentially contaminated via tracking from enrichments of less than 3%.[14] However, because

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[12] *Remedial Investigation Report for the East Tennessee Technology Park, Oak Ridge, Tennessee,* DOE/OR/01-1778/V1&D1, U. S. Department of Energy, January 1999.

[13] For the purposes of the site remedial investigation, a conservative approach was used and anything that was ≥1.0E-04 or had a hazardous index ≥1.0 was considered a contaminant of concern.

[14] Contracted Health Physics Technician Training handouts, K-25 Site, 1993.

this facility has been an administrative building throughout its history, it is assumed that the uranium would be from natural sources and the enrichment is approximately that of natural uranium, 0.72%.

Other radionuclides (^{60}Co, ^{137}Cs, $^{89/90}Sr$, ^{237}Np, ^{99}Tc, and $^{238/239/240}Pu$) have also been detected on-site at ETTP. These other radionuclides originated from the introduction of contaminated materials from Oak Ridge National Laboratory and/or from the Hanford and Savannah River reactor returns uranium reprocessing program; however, these radionuclides are expected to be found in much lower quantities than uranium and undetectable in this area, based upon its operational history as an administrative facility. If they were present, it is assumed that they would be present at ratios of 1140:1 for uranium to transuranic (U:TRU) and 350:1 for uranium to technetium-99 (U:^{99}Tc) [both ratios are process buildings weighted averages].[15]

6.3.1 Historical Surveys

A search of the BJC Radiation Control (RADCON) electronic survey data collected since 1996 revealed that 14 area surveys were performed in, or on, the building, including 6 surveys that covered the entire roof area. A review of these surveys provided the basis for the survey classification of the individual survey units.

Table 6.1. ETTP historical radiological surveys

19960320KA36158001	19980512KA36166005
19960320KA36158002	19980512KA36166006
19960422KA36158002	19980512KA36168001
19960422KA36158003	19980526KA36194010
19980508KA36168001	200011290029338005
19980508KA36168004	200011290029338006
19980512KA36166004	200108230029339002

Four surveys were conducted on the second floor during March and April 1996 because of the presence of pregnant workers. No elevated readings were detected in the offices (Rooms 2326, 2210, and 2005) or the women's restrooms (Rooms 2214 and 2372) except for the beta-gamma direct (total) readings on the floors of the restrooms, which ranged from 1300 to 2700 disintegrations per minute (dpm)/100 cm^2 and 1100 to 1900 dpm/100 cm^2 in Rooms 2214 and 2372, respectively. The elevated readings are attributed to the floors being made of glazed clay tiles, which have naturally occurring radioactive materials (NORM) in their clay matrices. The maximum removable alpha contamination detected was 117 dpm/large area wipe (LAW[16]); maximum beta-gamma removable contamination was 884 dpm/LAW (no actual smear surveys over 100-cm^2 areas were performed). Gamma radiation levels ranged from 4 to 18 μR/h [4 to 17 microrem per hour (μrem/h)]. It was noted on the survey documentation for Room 2005 that a radium dial clock was found on the wall and that the supervisor was notified to remove the clock from the site (no radiological readings were recorded by the technician). The clock is currently not in the room (as verified during a walkdown of the facility conducted on May 20, 2002).

A small, gray handcart was found with a contaminated wheel in the mechanical equipment room on the second floor in May 1998, during a building-wide, spot-check survey (6732 dpm/100 cm^2 total beta-gamma maximum reading; no total alpha or removable contamination was detected). The handcart was taken to Bldg. K-1401 and placed in a contamination area. The remainder of the facility had no detectable

[15] *Isotopic Distribution of Contamination Found at the U. S. Department of Energy Gaseous Diffusion Plants*, Science Applications International Corporation (SAIC) report delivered to Bechtel Jacobs Company LLC, SAIC document number 143.19991103.002, October 1999.

[16] A large area wipe (LAW) is normally taken over an area of approximately 1 m^2 (100 separate 100-cm^2 areas).

contamination distinguishable above background levels. No measurements of the ambient gamma radiation levels were taken for the spot-check surveys.

The roof area (including equipment) was surveyed in May 1998 with hand-held contamination meters as well as with a sodium iodide (NaI) gamma detector. No total or removable activity was found above background levels except where the brick wall that extends above the roofline at the edge of the roof was surveyed. No areas were found that were greater than twice the NaI ambient background level. The maximum reading was 2040 dpm/100 cm^2 total beta-gamma, which is attributed to the NORM found within red clay bricks' matrix. No exterior surveys were performed previously.

6.3.2 Current Surveys

A total of 85 surveys (including all associated quality assurance/control surveys) were conducted in the footprint. These surveys were performed from July 23 to August 28, 2002, in accordance with ETTP RADCON procedures,[17] the survey design document[18] (hereafter referred to as the "design document"), and the survey plan (see Appendix D). In addition, seven supplemental surveys of ancillary equipment located on the exterior of K-1007 that support the operation of the building were performed from December 9 to December 26, 2002, in accordance with the Addendum to the survey plan (see Table 6.2).

Table 6.2. ETTP current radiological surveys

20020723PA01388001	20020801PA01388001	20020812KA36145001	20020819PA01388001
20020725PA01388001	20020801PA01388002	20020812KA36145002	20020819PA01388002
20020725PA01388002	20020801PA01388003	20020812KA36145003	20020819PA01388003
20020725PA01388003	20020802KA36145001	20020812PA01388001	20020820PA01388001
20020726KA36145001	20020802PA01388001	20020812PA01388002	20020820PA01388002
20020726KA36145002	20020802PA01388002	20020812PA01388003	20020820PA01388003
20020726KA36145003	20020805KA38022001	20020813KA36145001	20020821KA36145001
20020726KA36145004	20020805PA01388001	20020813PA01388001	20020821KA36145002
20020726KA36145005	20020805PA01388002	20020813PA01388002	20020821KA36145003
20020729KA36145001	20020806KA38022001	20020813PA01388003	20020821PA01388001
20020729KA36145002	20020806PA01388001	20020813PA01388004	20020821PA01388002
20020729KA36145003	20020806PA01388002	20020813PA01388005	20020821PA01388003
20020729KA36145004	20020807KA36145001	20020814PA01388001	20020822KA36145001
20020730KA36145001	20020807KA36145002	20020815PA01388001	20020823KA36155001
20020730PA01388001	20020807PA01388001	20020815PA01388002	20020823PA01388001
20020731KA36145002	20020808PA01388001	20020815PA01388003	20020823PA01388002
20020731KA36145003	20020808PA01388002	20020816KA36145001	20020823PA01388003
20020731PA01388001	20020808PA01388003	20020816KA36145002	20020825KA36155001
20020731PA01388002	20020809PA01388001	20020816KA36145003	20020825KA36155002
20020801KA36145001	20020809PA01388002	20020819KA36145001	20020828KA36145001
20020801KA36145002	20020809PA01388004	20020819KA36145002	20020828PA01388001
20020801KA36145003	20021219XA50370001	20021220XA50370001	20021220XA50370002
20021220XA50370003	20021220XA50370004	20021226PA01388001	20021226XA50370001

Radiological survey procedures and area survey units were described in the survey plan presented in Appendix D. Each area was classified as either a Class 3, 2, or 1 survey unit based upon historical data

[17]Primarily SH-B-4012, "Radioactive Contamination Control and Monitoring," found in BJC-SH-04, Vol. I, *Radiation Protection Program.*

[18]BJC 2000. *Design of Radiological Surveys of Potential Lease Space at East Tennessee Technology Park, Oak Ridge, Tennessee*, BJC/OR-554, Bechtel Jacobs Company LLC, Oak Ridge, TN.

and process knowledge as described in the design document. All areas within the survey footprint were classified as Class 3.

Hand-held meter survey results were taken and compared to the following values (see Table 6.3), which are the appropriate 10 *Code of Federal Regulations* (*CFR*) 835[19]/DOE 5400.5[20] surface contamination criteria [referred to as derived concentration guideline levels (DCGLs) in the design document] for the survey area.

Table 6.3. Contamination limits (DCGLs) for all survey units

	DCGL (dpm/100 cm^2)	Class 3, 25% of DCGL (dpm/100 cm^2)	$DCGL_{EMC}$ (dpm/area)
Total alpha	5000	1250	15,000
Removable alpha	1000	250	N/A
Total beta-gamma	5000	1250	15,000
Removable beta-gamma	1000	250	N/A

DCGL = derived concentration guideline level.
$DCGL_{EMC}$ = derived concentration guideline $level_{elevated\ measurement\ comparison}$.
dpm = disintegrations per minute.
N/A = not applicable.

Each survey unit data set was first evaluated by comparing the minimum result to the maximum result. If the result of the maximum minus the minimum survey result was less than the appropriate class-specific DCGL limits, then the unit was said to pass and have rejected the null hypothesis, (H_o). The null hypothesis specifies that the residual contamination in each of the individual survey units exceeds the survey unit class-specific DCGL. If the difference between the maximum and minimum result was greater than the class-specific DCGL for a particular survey unit, then the non-parametrical statistical Sign test was used to evaluate the data as outlined in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM).

6.3.2.1 Interior survey units

All interior survey units (ISUs) of the K-1007 building were classified as Class 3 survey units. Per the design document, Class 3 survey units have an upper limit of 25% of the DCGL (i.e., 1250 dpm/100 cm^2 total activity). The Class 3 survey criteria for ISUs were the following: 10% scan of the primary traffic areas and work surfaces with floor monitors and hand-held meters (including usage of a floor monitor probe set up as a hand-held probe and calibrated to detect alpha and beta-gamma contamination for large area scans of non-floor surfaces), as appropriate; any location on the walls or ceiling that, using professional judgment, could potentially have residual radioactivity present was to be scanned over the suspected area and documented on the survey; no removal of suspended ceiling tiles or floor panels was required for this survey; 11 measurements of total and removable contamination, at a minimum, were recorded within each survey unit at locations determined during the scan survey to have the highest activity; a general dose rate walkover survey of each survey unit, using a Bicron MicroRem® meter[21], was performed to determine if any variations exist in the penetrating radiation dose rate; and dose rate measurements were obtained at a minimum of every 20 ft in hallways and large rooms. Several of the survey units have more than the

[19]*CFR* 1999. 10 *Code of Federal Regulations* 835, *Occupational Radiation Protection*; the values are taken from Appendix D, "Surface Radioactivity Values."

[20]DOE 1990. *Radiation Protection of the Public and Environment*, DOE Order 5400.5, Fig. IV-1, "Surface Contamination Guidelines," p. IV-6, U. S. Department of Energy, February 8, 1990.

[21]Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof.

minimum number of data points (11); the critical value for the Sign test was determined using the actual number of data points for each survey unit and an alpha error (Type I error) of 0.05. Refer to Fig. 6.1 for the first and second floor survey units.

All ISUs passed the Sign test evaluation. Therefore, the null hypothesis that the residual contamination in each of the individual survey units exceeds the Class 3 upper limit of 25% of the DCGL was rejected, meaning that any residual contamination in each ISU was below 1250 dpm/100 cm^2 total activity. From an inspection of the individual surveys, all total activities were less than 73.3 dpm/100 cm^2 total alpha and 722.0 dpm/100 cm^2 total beta-gamma, with all removable contamination results less than 11.8 dpm/100 cm^2 removable alpha and 54.2 dpm/100 cm^2 removable beta-gamma. The maximum tissue-equivalent dose rate was 12 μrem/h. See Table 6.4 for the summary of the survey results for all ISUs.

6.3.2.2 Exterior survey units

All exterior areas were classified as Class 3 exterior survey units (ESUs) and surveyed up to a minimum height of 8 ft with hand-held meters or with a gas-proportional probe, with an emphasis on air intakes/vents, windowsills, gutter downspouts, and any other area that the survey technician's professional judgment would indicate a higher probability of finding elevated readings. The building exterior walls and roof were covered under the initial survey plan. In addition, there are several places of ancillary equipment located on the exterior of K-1007 that support the operation of the building and will be included in the title transfer. The equipment, including chillers, air-conditioning units, and electrical transformers, was included in a supplemental survey conducted in December 2002.

All Class 3 ESUs were scan surveyed over a minimum of 10% of the accessible area, with 11 measurements of total and removable activity taken (alpha and beta-gamma) at locations having the highest activities, as determined during the scan survey. No tissue-equivalent dose rates were required per the survey plan. As with the ISUs, several of the survey units have more than the minimum number of data points (11); the critical value for the Sign test was determined using the actual number of data points for each survey unit and an alpha error (Type I error) of 0.05. See Fig. 6.2 for the exterior survey units and Fig. 6.3 for ancillary equipment survey units.

Most beta-gamma readings taken on the exterior of the building exceeded 1250 dpm/100 cm^2 total activity due to the NORM found in the red clay bricks' matrix.

The survey plan allowed for up to 2800 dpm/100 cm^2 total beta-gamma activity on red clay bricks. One of the beta-gamma results taken on the roof exceeded 1250 dpm/100 cm^2 total activity (1318 dpm/100 cm^2). However, this reading was taken in very close proximity to a corner of the roof, where two red clay brick walls intersect, thus increasing the amount of NORM detected in the general proximity. Due to the geometry of the reading location, this data point also had the 2800 dpm/100 cm^2 NORM content background applied to it. Taking these into account, all ESUs passed the Sign test evaluation, rejecting the null hypothesis. From an inspection of the individual surveys, all total activities were less than 112.9 dpm/100 cm^2 total alpha and 2699.6 dpm/100 cm^2 total beta-gamma, with all removable contamination results less than 11.8 dpm/100 cm^2 removable alpha and 74.1 dpm/100 cm^2 removable beta-gamma. See Table 6.4 for the summary of the survey results for all ESUs.

6.3.2.3 Furnishings survey units

All furnishing survey units (FSUs) were classified as either Class 3 or Class 2, based upon their as-found condition, process knowledge, and historical data, if available. Furnishings are defined as any item typical of an office (i.e., desks, chairs, tables, bookcases, trash cans, etc.). Class 3 FSUs consisted of the newer furnishings and were scanned over 5% of all accessible areas, with a maximum surface area not to exceed 5000 m^2. Class 2 FSUs consisted of the older furnishings and were scan surveyed over 10% of

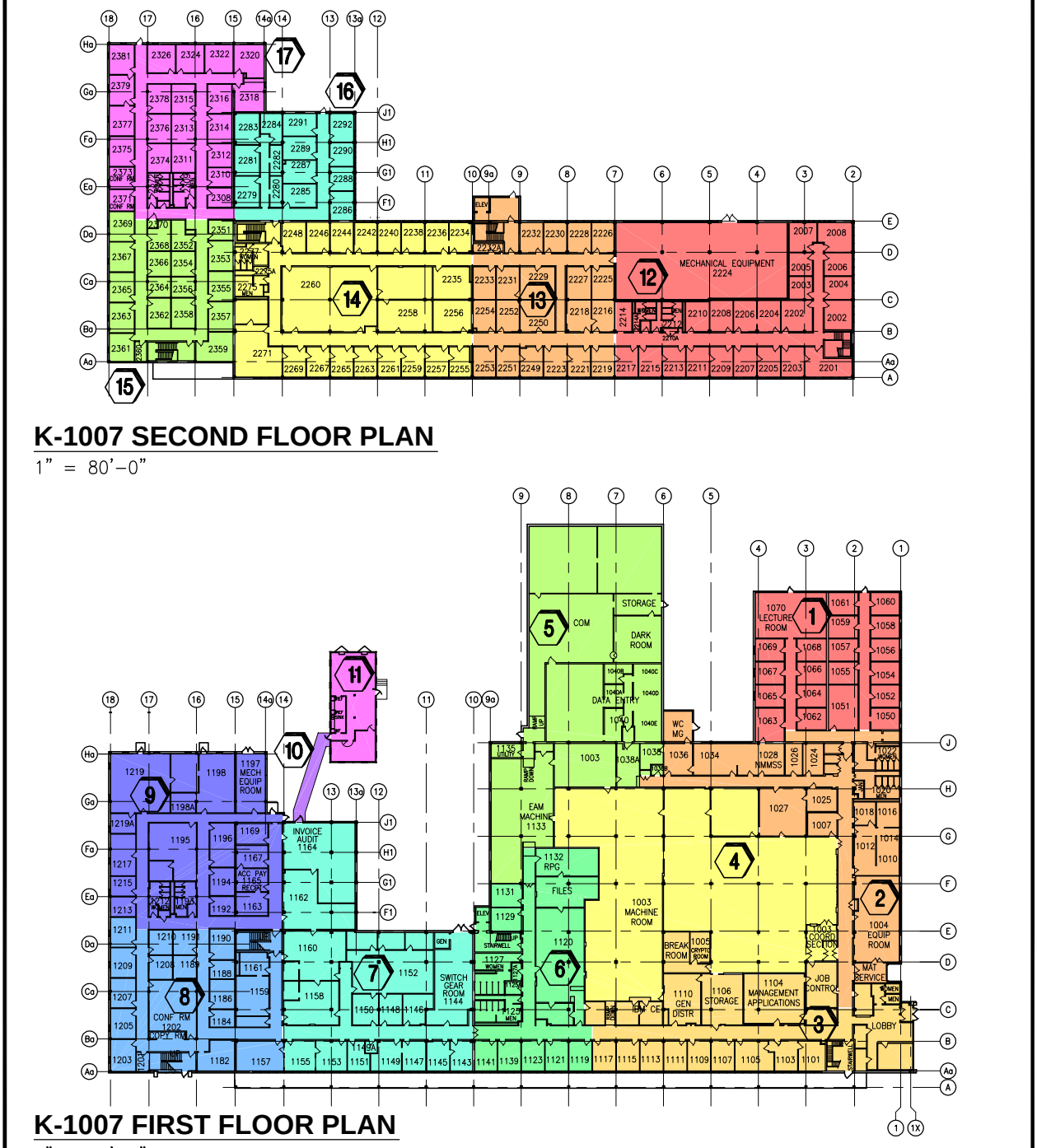
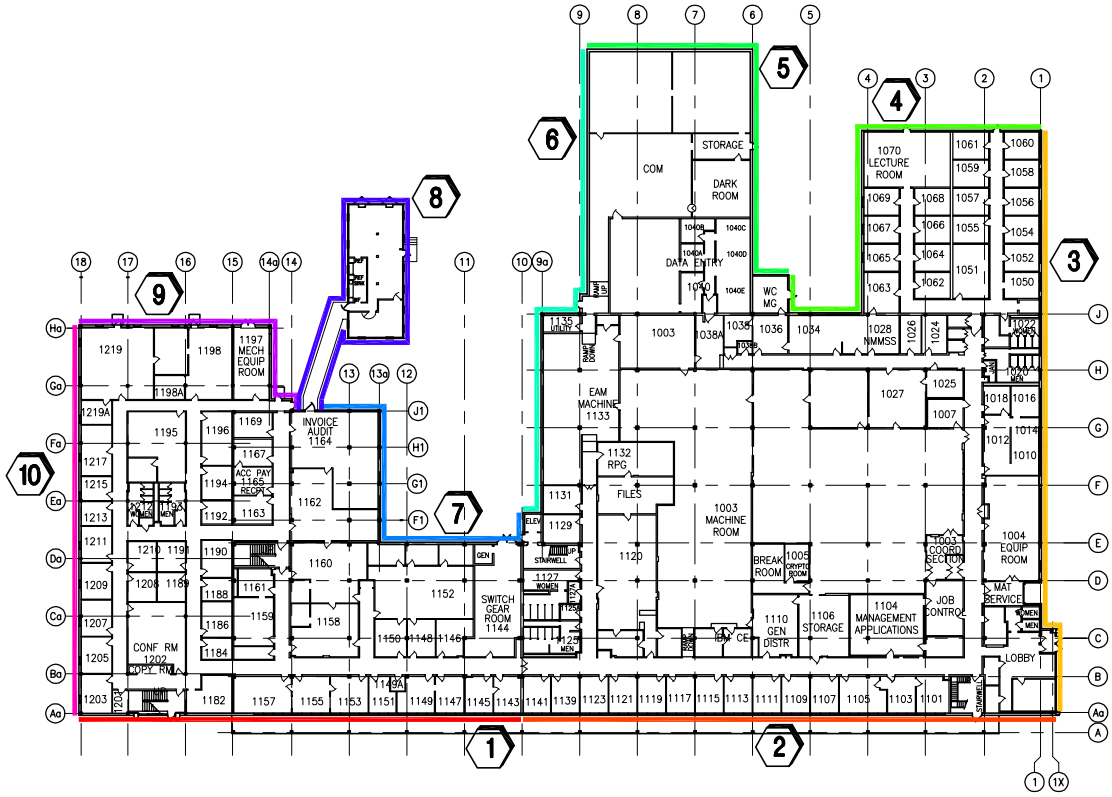


Fig. 6.1. K-1007 interior survey units.



K-1007 FIRST FLOOR PLAN

1" = 80'-0"

LEGEND:

2 .....SURVEY UNIT ID

5.39°±

ETTP GRID TRUE NORTH

0 40 80

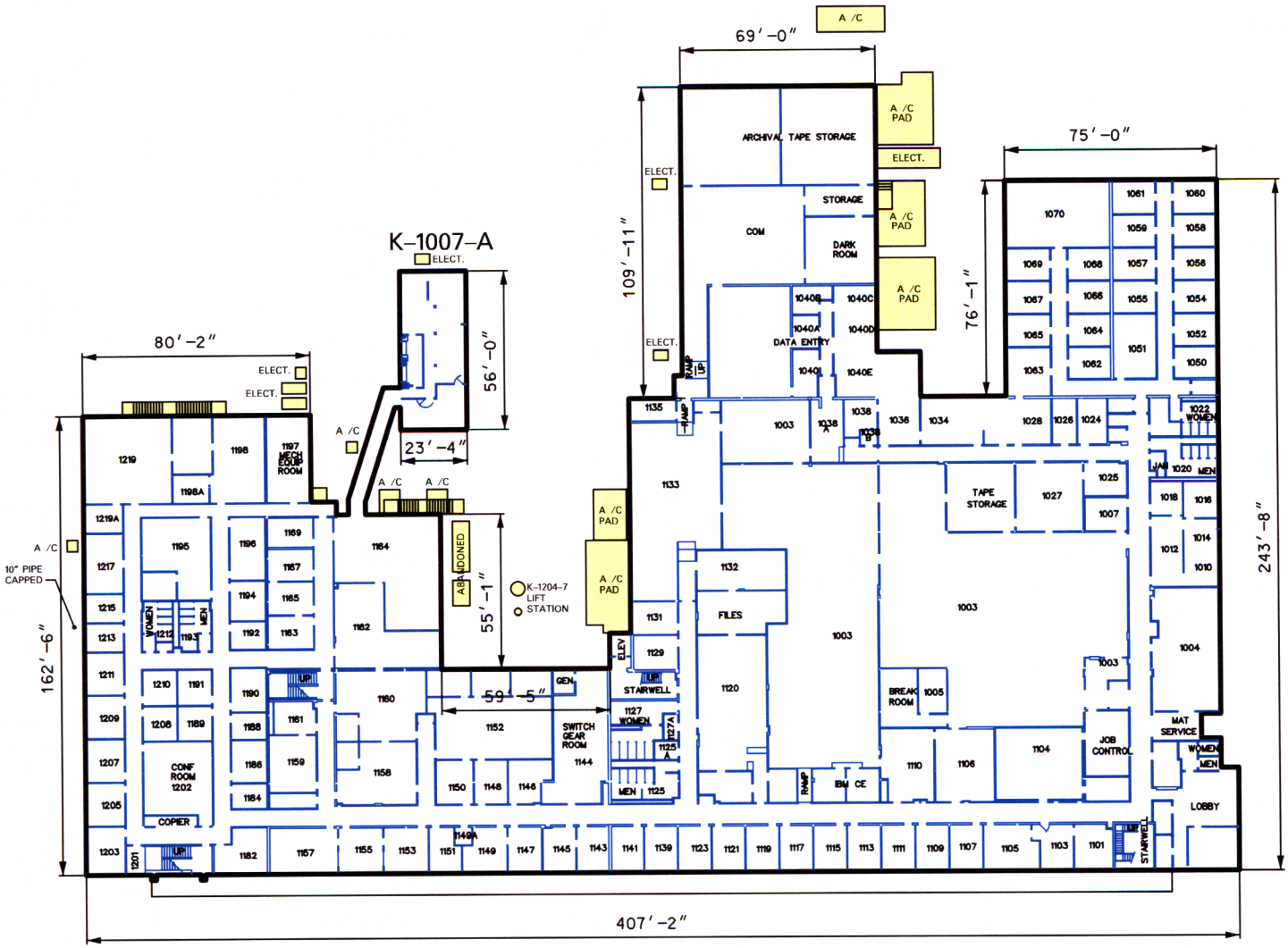
SCALE: 1" = 80'

Science Applications International Corporation

EAST TENNESSEE TECHNOLOGY PARK
OAK RIDGE, TENNESSEE

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	0 / 04-03-03	/00007/DWGS/P80SURV2

Fig. 6.2. K-1007 exterior survey units.



0 50 100
SCALE IN FEET

LEGEND

K–1007 /K–1007–A MAIN FACILITIES

EXTERIOR SUPPORT UNITS

K-25 PLANT NORTH

East Tennessee Technology Park
K–1007 FIRST FLOOR PLAN
TRANSFER FOOTPRINT

Fig. 6.3. Ancillary equipment located on the exterior of K-1007.

Tetra Tech, Inc.
OAK RIDGE, TENNESSEE
1903 921 07 k1007f1a2.dgn

Table 6.4. Summary of contamination and dose rates for the K-1007 study area

Location	Alpha total (dpm/100 cm²)		Alpha removable (dpm/100 cm²)		Beta-gamma total (dpm/100 cm²)		Beta-gamma removable (dpm/100 cm²)		Dose equivalent rate (μrem/h)
	Min	Max	Min	Max	Min	Max	Min	Max	
Interior survey units									
ISU 1	< 0	59	< -190.86	5.38	< -565.02	132	< -33.24	< 30.47	5 – 10
ISU 2	< 0	56.44	< -2.69	5.38	< -310.86	< 141.13	< -52.63	< 30.47	4 – 9
ISU 3	< -28.22	< 14.11	< -2.69	< 0	< -349.91	706.5	< -44.32	< 13.85	5 – 12
ISU 4	< -14.7	< 29.4	< 0	5.38	< -407.55	< 62.7	< -41.55	47.09	2 – 6
ISU 5	< 14.65	43.95	< 0	8.07	< -659.18	< 62.78	< -24.93	< 44.32	3 – 7
ISU 6	< -23.22	< 28.22	< 0	8.07	< -310.86	< 395.64	< -60.94	< 11.08	3 – 7
ISU 7	< -16.75	< 29.3	< 0	5.38	< 0	721.97	< -44.32	< 27.7	3 – 8
ISU 8	< -29.3	43.95	< -2.69	< 2.69	< -62.78	< 439.36	< -38.78	< 33.24	3 – 8
ISU 9	< -29.3	< 29.3	< 0	5.9	< -439.36	< 376.68	< -39.9	< 17.1	3 – 8
ISU 10	<-14.65	58.6	< 0	5.9	< -408.07	< 219.73	< -59.9	< 17.1	3 – 4
ISU 11	< 14.65	43.95	< -2.95	11.8	< -690.58	< 125.56	< -31.35	< 28.5	3 – 8
ISU 12	< 0	73.25	< -2.69	5.38	< -156.95	< 439.46	< -49.86	< 22.46	3 – 8
ISU 13	< -16.75	73.25	< -2.95	< 2.95	< -313.9	< 376.88	< -48.45	54.15	3 – 8
ISU 14	< 0	58.6	< 0	5.38	< -376.68	< 282.51	< -16.62	< 47.09	3 – 8
ISU 15	< 0	58.6	< 0	8.07	< -470.85	< -31.39	< -58.17	< 30.47	2 – 7
ISU 16	< 0	58.6	< 0	< 2.69	< -376.68	< 282.51	< -11.08	< 44.32	4 – 8
ISU 17	< 0	58.6	< -2.95	< 0	< -627.8	< -156.95	< -17.1	< 37.05	2 – 6
Exterior survey units									
ESU 1	< 0	70.55	< -2.69	< 2.69	< -282.6	1186.92	< -36.01	< 24.93	NR
ESU 2	< 0	56	< -2.69	8.07	< 678.24	1102.14	< -52.63	< 36.01	NR
ESU 3	< 0	< 29.3	< -2,69	8.07	< 156.95	2668.15	< -24.93	72.02	NR
ESU 4	< 0	43.95	< 0	5.38	816.14	2699.54	<-174.51	< 13.85	NR
ESU 5	< 0	43.95	< 0	5.38	< 188.34	2417.03	< -27.7	< 36.01	NR
ESU 6	< 0	< 29.3	< 0	8.07	1130.04	2417.03	< -13.85	< 16.62	NR
ESU 7	< 14.11	84.66	< -2.69	< 2.69	299.96	2430.36	< -58.17	< 0	NR
ESU 8	< 0	42.33	< -2.69	< 2.69	< -649.98	< 141.3	< -52.63	< 27.7	NR
ESU 9	< 0	98.77	< 0	8.07	< -565.2	< 282.6	< -60.94	< 13.85	NR
ESU 10	< 28.22	112.88	< 0	5.38	< -649.98	< 113.04	< -58.17	< 24.93	NR
ESU 11	< 0	102.55	< -2.95	11.8	< -565.02	1318.38	< 8.55	74.1	NR

Table 6.4. Summary of contamination and dose rates for the K-1007 study area (continued)

Location	Alpha total (dpm/100 cm²)		Alpha removable (dpm/100 cm²)		Beta-gamma total (dpm/100 cm²)		Beta-gamma removable (dpm/100 cm²)		Dose equivalent rate (μrem/h)
	Min	Max	Min	Max	Min	Max	Min	Max	
Furnishings survey units – Class 3									
FSU 1	< 0	58.6	< 0	5.38	< -251.12	565.02	< -48.86	< 24.93	NR
FSU 2	< 0	73.25	< -2.69	< 2.95	< -685.65	< 424.45	< -52.63	< 34.2	NR
FSU 3	< 0	58.6	< -5.38	5.9	< -522.4	< 251.12	< 0	57	NR
FSU 4	< 0	44.11	< -2.69	9	< -946.85	< 192.83	< -52.63	74	NR
FSU 5	< 0	58.6	< 0	10.76	< -910.31	< -62.78	< -19.39	< 38.78	NR
FSU 6	< 0	43.95	< 0	10.76	< -359.15	< 345.29	< 5.7	63	NR
FSU 7	< 0	43.95	< 0	5.38	< -690.58	< 376.68	< -58.17	86	NR
FSU 8	< 0	87.9	< 0	6	< -848.95	< 408.07	< -11.08	< 41.55	NR
FSU 9	< 0	58.6	< 0	8.07	< -910.31	< -313.9	< -22.16	< 36.01	NR
FSU 11	< 0	73.25	< 0	9	< -653	< 0	< -38.78	< 39.9	NR
FSU 12	< 0	58.6	< 0	8.07	< -587.7	< 195.9	< -22.16	58.17	NR
FSU 13	< 0	73.25	< 0	9	< -587.7	< 326.5	< 0	71	NR
FSU 14	< 0	43.94	< -2.95	9	< -848.9	< 156.95	< -14.25	51	NR
FSU 15	< 0	102.55	< 0	6	< -816.25	< 345.29	< -13.85	51	NR
FSU 16	< 0	58.6	< 0	5.38	< -620.35	< 522.2	< -5.7	58.17	NR
FSU 17	< 0	131.85	< -2.95	6	< -816.25	847.53	< -31.35	63	NR
Furnishings survey units – Class 2									
FSU 1	< 0	58.6	< -2.69	6	< -620.35	< 424.45	< -41.55	< 24.93	NR
FSU 2	< 14.11	87.9	< -2.69	< 0	< -718.3	< 84.78	< -36.01	< 22.16	NR
FSU 3	< 0	< 14.65	< -5.38	6	< -826.25	< 31.39	< -16.62	< 36.01	NR
FSU 4	< 0	56.44	< -2.69	< 2.69	< -367.38	< 192.82	< -55.4	< 30.47	NR
FSU 5	< 0	58.6	< 0	10.76	< -973.09	< 94.17	< -36.01	< 27.7	NR
FSU 6	< 0	43.95	< -2.69	< 2.69	< -489.75	< 439.46	< -22.16	47.09	NR
FSU 7	< 0	58.6	< -2.69	< 2.69	< -718.3	< 0	< -171.74	< 36.01	NR
FSU 8	< 0	58.6	< -2.69	5.38	< -653	< 31.39	< -16.62	52.63	NR
FSU 9	< 0	307.65	< 0	8.07	< -690.58	< -125.56	< -24.93	63.71	NR
FSU 11	< 0	< 29.3	< -2.69	< 2.69	< -1110.1	< 391.8	< -30.47	< 24.93	NR
FSU 12	< 0	58.6	< -2.69	8.07	< -620.35	< 391.8	< -27.7	96.95	NR
FSU 13	< -14.65	< 29.3	< -2.69	5.38	< -457.1	< 156.95	< -27.7	< 27.7	NR

Table 6.4. Summary of contamination and dose rates for the K-1007 study area (continued)

Location	Alpha total (dpm/100 cm²)		Alpha removable (dpm/100 cm²)		Beta-gamma total (dpm/100 cm²)		Beta-gamma removable (dpm/100 cm²)		Dose equivalent rate (μrem/h)
	Min	Max	Min	Max	Min	Max	Min	Max	
FSU 14	< 0	58.6	< -2.95	< 2.69	< -718.3	< 282.51	< -30.47	< 37.05	NR
FSU 15	< 0	73.25	< -2.69	8.07	< -946.85	< 327.68	< -16.62	85.87	NR
FSU 16	< 0	73.2	< -2.69	5.38	< -489.75	< 408.07	< -8.31	63.71	NR
FSU 17	< 0	58.6	< -2.69	5.9	< -685.65	< -94.17	< -37.05	< 17.1	NR
Supplemental Exterior Survey Units (Ancillary Equipment)									
Concrete pads	< -15.54	< 5.38	< 0	8	< 305.8	642.18	< -36.01	58	4-6
A/C Unit 1	< 0	< 46.62	< 0	11	< -489.28	< 275.22	< -63.71	< 22.16	3-6
A/C Unit 2	< -15.54	< 31.08	< 0	< 5.38	< -917.4	< 428.12	< -38.78	< 16.62	3-7
A/C Unit 3	< 0	< 31.08	< 0	< 5.38	< -335.94	< 122.32	< -27.7	< 16.62	3-5
Pumps	< 0	< 31.08	< 0	8	< -2214.06	< 305.8	< -41.55	< 16.62	3-5
Transformers	< -15.54	< 31.08	< 0	8	< -183.48	581	< -27.7	< 16.62	5-6
DOE limits	5000		1000		5000		1000		20

Notes: All readings are in units of disintegrations per minute (dpm)/100 cm².
A "<" preceding a value indicates that the result cannot be distinguished from background at the 95% confidence level.
"NR" denotes that no reading was taken.
A/C = air-conditioning.
DOE = U. S. Department of Energy.
dpm = disintegrations per minute.

their accessible surfaces, with a maximum FSU area of 1000 m^2. A minimum of 11 data points was collected from each FSU at the areas of the highest activity as determined during the scan survey.

Class 3 FSUs. All Class 3 FSUs passed the Sign test, rejecting the null hypothesis. Activities were less than 131.9 dpm/100 cm2 total alpha and 847.5 dpm/100 cm2 total beta-gamma, with all removable contamination results less than 10.8 dpm/100 cm^2 removable alpha and 86 dpm/100 cm^2 removable beta-gamma. See Table 6.4 for the summary of the survey results for all FSUs.

Class 2 FSUs. All Class 2 FSUs passed the Sign test, rejecting the null hypothesis. Maximum activities detected were 307.7 dpm/100 cm^2 total alpha, 439.5 dpm/100 cm^2 total beta-gamma, 10.8 dpm/100 cm^2 removable alpha, and 97 dpm/100 cm^2 removable beta-gamma. See Table 6.4 for the summary of the survey results for all FSUs.

6.3.2.4 Quality assurance/control surveys

A 5% verification survey of the data gathered from each survey unit was performed in each survey unit for quality control/assurance. All quality control/quality assurances survey data gathered were in agreement with the initial survey unit data.

6.3.3 Survey Data Review and Analysis

A DOE contractor health physicist reviewed all survey data prior to use in this report. All surveys were conducted in accordance with the survey plan per the contractor health physicist (correct number of survey units, data points per survey unit, instrumentation data, quality control/assessment survey performed, etc.).

Results of the surveys performed in the study area and the statistical test performed on the data gathered in each survey unit indicate that the interior, exterior, and present furnishings are below the DOE surface contamination limits and within the acceptable dose equivalent rate range for building interiors. The null hypothesis was rejected for each survey unit based upon the non-parametrical statistical Sign test. Therefore, the alternative hypothesis (H_a) is accepted, which states that the residual radioactivity in each of the survey units does not exceed the DCGL and, therefore, can be released without restrictions.

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APPENDIX A

REAL ESTATE LETTER

PROPOSED TRANSFER OF ETTP BUILDINGS
OAK RIDGE RESERVATION, TN

FILES RESEARCH FOR HAZARDOUS SUBSTANCE ACTIVITY

The following statement is provided in support of guidance promulgated under Section 120(h) of the Comprehensive Environmental Response, Liability, and Compensation Act, as amended (CERCLA) 42 U.S.C. 9620(h) and in support of regulations issued by the Environmental Protection Agency at 40 CFR part 373.

The undersigned has made a complete search of existing and available Department of Energy (DOE) records, documentation, and data within the real estate files relating to the property that is subject to the proposed fee transfer action of Buildings K-1007, K-1035, K-1036, K-1225, K-1330, K-1400 and K-1580 at the East Tennessee Technology Park within the Oak Ridge Reservation, Tennessee. The proposed action would result in transfer to the Community Reuse Organization of East Tennessee (CROET) under a 10 CFR 770 Proposal. The search conducted was considered reasonable with a good faith effort expended to identify whether any hazardous substances were stored for one year or more, released, or disposed of on the property. The available real estate records of this office do not reflect any determinable reference that hazardous substance activity as defined by Section 101(14) of CERCLA took place on or in the property during the time the property was owned by the United States of America.

Lands affected by this action are identified as portions of the following original acquisition tracts in which the United States of America acquired title, (having been acquired for the Atomic Energy Commission as a forerunner of the Department of Energy) by Civil Action No. 429 filed in the United States District Court for the Eastern District of Tennessee, Northern Division:

a. Buildings K-1035, K-1036, and K-1400 are located on a portion of **Tract H-719**. Title to this land was vested in the United States of America by Declaration of Taking No. 26 dated March 19, 1943. Judgment on Declaration of Taking was filed for public record on March 30, 1943 in Vol. Y-5, page 515 in the Roane County Register's Office, Tennessee.

b. Buildings K-1225, K-1330, and K-1580 are located on a portion of **Tract H-720**; and Building K-1007 is located on a portion of **Tract H-731**. Title to this land was vested in the United States of America by Declaration of Taking No. 19 dated February 8, 1943. Judgment on Declaration of Taking was filed for public record on February 23, 1943 in Vol. Y-5, page 136 in the Roane County Register's Office, Tennessee.

This record shall be made a part of the CERCLA report currently being prepared.

Katy Kates

Katy Kates, Realty Officer
Oak Ridge Operations Office
Department of Energy
August 8, 2003

Attachment-Plat Exhibit

APPENDIX B

STUDY AREA MAPS FROM RECORDS SEARCH

Location of Pre–World War II Structures and Cemeteries in or near the East Tennessee Technology Park

LEGEND

- Pre–World War II Structures
- Cemeteries
- Buildings
- Roads
- Water Bodies
- Streams

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DATA COMPLIED BY GRID IS NAD 83 FEET
ER REMOTE SENSING PROGRAM
ENVIRONMENTAL INFORMATION MANAGEMENT PROGRAM
GEOGRAPHIC INFORMATION SCIENCES AND TECHNOLOGY GROUP
ORIGINAL BY: BARGE, WAGGONER, SUMNER AND CANNON, INC.
REVISED BY: TETRA TECH, INC. 2/1001

KMAPS ORO HISTORIC MAP GSL

APPENDIX C

SAMPLING AND ANALYSIS PLAN FOR THE K-1007 BUILDING

Sampling and Analysis Plan for Collection of Groundwater, Air, and Soil Vapor Samples for the K-1007 Building at the East Tennessee Technology Park, Oak Ridge, Tennessee

This document is approved for public release per review by:

BJC ETTP Classification and Information Control Office — Date: 13JAN04

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

BJC/OR-1715

Sampling and Analysis Plan for Collection of Groundwater, Air, and Soil Vapor Samples for the K-1007 Building at the East Tennessee Technology Park, Oak Ridge, Tennessee

Issued—January 2004

Prepared for the
U. S. Department of Energy
Assets Utilization

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
East Tennessee Technology Park
Y-12 National Security Complex Oak Ridge National Laboratory
Paducah Gaseous Diffusion Plant Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-98OR22700
for the
U. S. DEPARTMENT OF ENERGY

02-219(doc)/011004

CONTENTS

FIGURES

TABLES

ACRONYMS

bgs	below ground surface
COPC	chemical of potential concern
DOE	U. S. Department of Energy
DCE	dichloroethene
ELCR	Excess Lifetime Cancer Risk
EPA	U. S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
FFA	Federal Facility Agreement
GC/MS	gas chromatography/mass spectrometry
PCE	tetrachloroethylene
MCL	maximum contaminant level
PRG	preliminary remediation goal
PSS	Park Shift Superintendent
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SSC	sampling subcontractor
SWMU	solid waste management unit
TCA	trichloroethane
TCE	trichloroethene
TIC	tentatively identified compound
UST	underground storage tank
VOC	volatile organic compound

1. INTRODUCTION

This Sampling and Analysis Plan (SAP) describes sampling efforts to be undertaken in order to determine whether subsurface contamination from volatile organic compounds (VOCs) has resulted in organic vapors entering the K-1007 building. This plan was developed as part of an effort to address concerns raised by U. S. Environmental Protection Agency (EPA) Region 4 regarding the potential for vapor intrusion of VOCs from shallow groundwater into buildings at the East Tennessee Technology Park (ETTP) that are proposed for transfer.

Building K-1007 is located in the southern portion of ETTP, west of the main entrance (Portal 2), off the Oak Ridge Turnpike/Highway 58. It is a two-story, concrete-framed building with over 113,000 ft^2 of floor space and has been used as an office area and systems support building for ETTP. Portions of the building have been leased since 1998.

This SAP presents the rationale and details of air sampling to be conducted in the ETTP K-1007 building. These sampling activities are being conducted to determine the potential for vapor intrusion into the building by VOCs that may be present in the subsurface. The VOCs selected for analysis are those present in the groundwater in close proximity to the building.

2. OPERATIONS CONDUCTED WITHIN PROXIMITY OF THE K-1007 BUILDING

Several former facilities are potential areas of contamination that are in close proximity to Bldg. K-1007. These areas are listed as environmental restoration units in *Site Descriptions of the Environmental Restoration Units at the Oak Ridge K-25 Site, Oak Ridge, Tennessee*, K/ER-47/R1 (Energy Systems 1995). This report was prepared to "baseline" conditions (at the time of the evaluation) so that decisions could be made to establish cleanup priorities. The areas described below (from that baselining report) are also listed in Appendix C of the Federal Facility Agreement (FFA).

1. K-1007-P1 Holding Pond – The K-1007-P1 Holding Pond is located to the south and southeast of Bldg. K-1007. It receives storm drainage and wastes from the K-1004 Area lab drain. Since 1985, discharges from the K-1004 Area laboratory drain have been limited to water and soap from the cleaning of glassware. Prior to 1985, an estimated 2200 gal of laboratory wastes were discharged through the lab drains to the pond. Waste chemicals included solvents, acids, bases, organics, and metals. Uranium-containing solutions from the analytical laboratories were not routinely disposed of in the area lab drains. Polychlorinated biphenyl contamination has also been detected in the pond. The K-1007-P1 Holding Pond is listed as a Solid Waste Management Unit under the Resource Conservation and Recovery Act of 1976 (RCRA).

2. K-1007 Gas Tank – The former K-1007 Gas Tank was a gasoline underground storage tank (UST) for the K-1007 emergency generator. It was located within the courtyard formed by the "U" shape of the K-1007 building, near the K-1007-A Canteen. In 1986, it was determined that the UST was leaking and that gasoline had entered the sanitary sewer lift station. The gasoline was removed from the lift station, and the tank was also removed along with 14 tons of contaminated soil.

3. K-1047 Motor Pool Repair Shop – Originally designated as Bldg. 628 when it was built in 1943 or 1944, it was later re-designated as K-1047 in 1946. This building was used to service personnel

carriers as a motor pool repair shop. In 1948, it was converted to a lumber warehouse. By 1958, the building had been demolished. The K-1047 building was located approximately 100 ft north of Bldg. K-1007 in the present parking lot.

4. The K-1048 Tire and Battery Shop – Building K-1048 was built in 1943 and designated as Bldg. 634. In 1946 it was re-designated as K-1048. By 1951, the shop was no longer in use, and by July 1958 the building had been demolished. The K-1048 building was located in the same location as the former K-1007 Gas Tank.

5. K-1050 Wash, Grease, and Paint Shop – This facility was originally built in 1943 and designated as Bldg. 640. It was used to wash and lubricate motorized fleet equipment to minimize undercarriage damage. By 1946, the building had been re-designated as K-1050. Work orders indicate a paint shop was included in the building. By 1960, the building had been demolished. The K-1050 building was located immediately to the north of Bldg. K-1007-A.

6. Building 665 Steam Shed – The Building 665 Steam Shed was built in 1943 as part of a six-building cleaning operation during construction of the K-27 and K-29 cascade buildings. Because of its proximity to an area of heavy and light equipment repair shops, it is believed that this operation was used to clean the undercarriages of construction vehicles that traveled the construction site. The building was demolished by 1946. The 665 building was located in the northeast corner of the parking lot north of Bldg. K-1007.

7. 600 Oil Storage Area – The 600 Oil Storage Area was located to the west of Bldg. K-1007 where Avenue "J" and Contractors Road meet. In the early 1940s, the oil storage area consisted of three aboveground oil tanks designated as 610, 612, and 614. These tanks were mounted on concrete support saddles and had an estimated capacity of 5 to 10,000 gal per tank. By 1946, the tanks had been redesignated as K-1076, K-1077, and K-1078. By 1951, the tanks had been removed.

8. K-1055 Gasoline/Diesel Station – The K-1055 Gasoline/Diesel Station was in use as early as 1944 for the construction operations for the site. One UST with dimensions of 26 ft long with a 6-ft diameter served the station. The capacities of the other tanks that may have existed are unknown. The facility had been demolished by the 1950s. It was located in the grassy field north of the parking lot north of Bldg. K-1007.

Prior to 1996, there were four office trailers, K-1310-Q, -R, -CY, and –CZ, located in a gravel lot on the northeast corner of K-1007 within the perimeter fence. Trailers K-1310-CY and -CZ were removed in late 1996. Trailers K-1310-R and -Q were removed in 1997. An additional office trailer, K-1556, was located outside the perimeter fence on the western edge of the parking lot north of Bldg. K-1007. It was removed in 2001.

3. EXISTING/HISTORICAL DATA

Four unconsolidated zone monitoring wells and three bedrock wells have been installed in the vicinity of Bldg. K-1007. The hydrogeologic characterization data discussed below for K-1007 are based on the data from these wells. The locations of these wells are depicted in Fig. 3.1.

Depth to bedrock and depth to groundwater beneath K-1007 can be determined from the wells drilled in the vicinity of the building. Based on data from these wells, depth to bedrock ranges from 2 to 20 ft

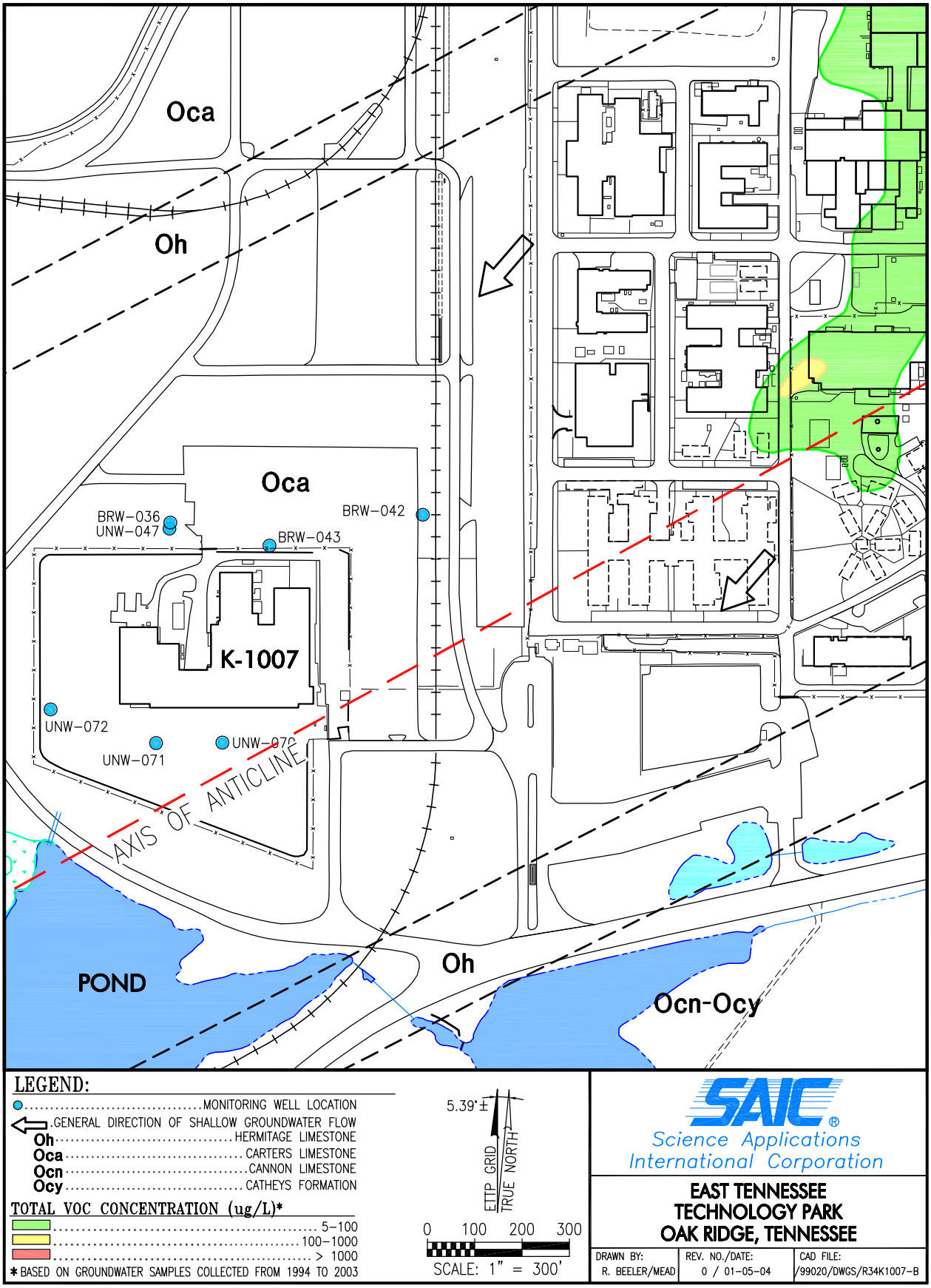

Fig. 3.1. Groundwater VOC concentrations in the vicinity of K-1007.

below ground surface (bgs). The depth to groundwater at K-1007 ranges from 4 to 10 ft bgs in the vicinity of the building. The depth to water becomes shallower moving from north–northeast to south–southwest in the vicinity of the building. Shallow groundwater flow is to the south–southwest at K-1007.

Groundwater samples collected from both unconsolidated zone and bedrock wells in the vicinity of Bldg. K-1007 (Fig. 3.1) have indicated the sporadic occurrence of low, estimated concentrations of trichloroethene (TCE) and other VOCs. TCE has been detected at unconsolidated zone wells UNW-047, UNW-071, and UNW-072, located on the north and south sides of K-1007, at concentrations ranging from an estimated 1 microgram per liter (μg/L) to 14 μg/L. Only the September 1997 sample at UNW-071 (14 μg/L) and the September 1995 sample at UNW-072 (8 μg/L) exceeded the Primary Drinking Water Standard maximum contaminant level (MCL) for TCE of 5 μg/L. In addition to TCE, 1,1,1-trichloroethane (TCA), 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), 1,2-DCE, 2-butanone, acetone, methylene chloride and tetrachloroethene (PCE) have been reported during at least one sampling event at the unconsolidated zone wells located in the vicinity of K-1007. Detections of these compounds were sporadic in nature, and these compounds were not detected in the most recent sampling events at these wells.

TCE has also been detected in bedrock wells BRW-042 and BRW-043, located on the north side of Bldg. K-1007, at concentrations ranging from an estimated concentration of 1 μg/L to 15 μg/L. Only the October 1994 sample at BRW-042 (15 μg/L) exceeded the MCL of 5 μg/L for TCE. In addition to TCE, the compounds 1,2-DCE, acetone, PCE, and toluene have been reported during at least one sampling event at the bedrock wells located adjacent to K-1007. Acetone, PCE, and toluene were detected in only a single sampling event from 1994 to 1998. Only TCE at wells BRW-042 and BRW-043 has been detected in the most recent sampling events at the bedrock wells. The source of these compounds in these wells is currently undetermined.

Concentrations of VOCs in a groundwater plume from an identified upgradient source near K-1007, (located over 1000 ft to the northeast of K-1007) are similar to those reported for monitoring wells adjacent to the building. The concentrations of TCE at the leading edge of the nearest plume range from nondetect to 20 μg/L, concentrations of 1,2-DCE range from nondetect to 7 μg/L, and concentrations of PCE range from nondetect to 13 μg/L. Given the distance from K-1007 to the nearest upgradient groundwater plume (+1000 ft) and the natural attenuation processes that would affect VOC concentrations in this plume, it appears likely that any potential future VOC concentrations at K-1007 would not exceed reported historical concentrations. The historical maximum concentration of TCE is 14 μg/L reported for monitoring well UNW-071. This well has also contained the maximum 1,1,1-TCA (19 μg/L), 1,1-DCA (5 μg/L), and 1,1-DCE (2 μg/L) concentrations. Unconsolidated zone well UNW-071 is downgradient from Bldg. K-1007.

4. SCOPE

The overall scope of this SAP is to determine VOC concentrations in the soil vapor directly beneath the K-1007 building slab and in the building indoor air at normal breathing zone heights to evaluate the vapor intrusion pathway. This overall objective will be met by sampling soil vapor directly beneath the slab of the lowest floor using EPA-approved methods with detection limits that are sufficient to meet the requirements of the risk assessment. If VOC concentrations in the soil vapor directly beneath the building slab exceed trigger levels specified in this SAP, indoor air samples will be collected at normal breathing zone height from within the building to determine exposure concentrations. Indoor air samples will also be collected using EPA-approved methods with detection limits that are sufficient to support the risk assessment. In addition, to assess a potential change in site conditions, an upgradient groundwater monitoring well or soil gas well will be sampled.

5. OBJECTIVES AND RATIONALE

5.1 SAMPLING OBJECTIVES

EPA recently issued *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (EPA 2002).[1] The draft guidance provides a tiered approach to determine if the vapor intrusion pathway is complete and if any exposures that occur present unacceptable risks. The three tiers in the evaluation approach are:

- Tier 1 – Primary Screening, designed to be used with general knowledge of a site and the chemicals known or reasonably suspected to be present in the subsurface;
- Tier 2 – Secondary Screening, designed to be used with some limited site-specific information about the contamination source and subsurface conditions; and
- Tier 3 – Site-Specific Pathway Assessment, which involves collecting more detailed, site-specific information and conducting confirmatory sub-slab and/or indoor air sampling.

The first tier is intended to provide a rapid screening of whether the vapor intrusion pathway is potentially complete at the site. In the Tier 1 evaluation, the user determines whether chemicals of sufficient volatility and toxicity are present in the vadose zone or groundwater at the site and if receptor locations are sufficiently close (~100 ft from the source) to present an exposure potential. If these criteria are met, the user subsequently evaluates whether conditions exist that warrant immediate action to verify whether the pathway presents unacceptable risks and, if necessary, eliminates those risks. Conditions that may warrant immediate action to verify or eliminate risks from the vapor intrusion pathway include odors within buildings, wet basements where VOCs are present in shallow groundwater, and physiological effects reported by receptors.

The second tier provides generic screening criteria based on an excess lifetime cancer risk (ELCR) range of 10^{-6} to 10^{-4} and conservative attenuation factors. The Tier 2 evaluation is intended to allow the user to eliminate the vapor intrusion pathway, if the generic screening criteria are not exceeded. Certain site conditions make the use of the generic screening criteria inappropriate. These conditions include:

- very shallow groundwater sources at depths of less than 5 ft below foundation level, or
- relatively shallow soil or groundwater sources (at depths of less than 15 ft below the foundation) and the presence of significant openings or preferential pathways in the building to the subsurface such as sumps, unlined crawl spaces, or utility corridors.

If the generic screening criteria are exceeded or the above conditions exist, a Tier 3 evaluation is required. In the Tier 3 evaluation, the draft guidance recommends sampling sub-slab soil vapor and indoor air.

As previously stated, EPA Region 4 has raised concerns regarding the potential for vapor intrusion of VOCs from shallow groundwater into buildings at ETTP that are proposed for transfer. Using the draft guidance provided by EPA Region 4 personnel, it has been determined that a few buildings at ETTP that are proposed for the transfer, meet the Tier 1 criteria (presence of VOCs and proximity to source). In general, the Tier 2 screening criteria are not applicable to facilities being considered for transfer because

[1]Available on the World Wide Web at http://www.epa.gov/epaoswer/hazwaste/ca/eis/vapor/complete.pdf.

of the shallow depth to groundwater and limited depth to bedrock that exhibits karst features. Therefore, EPA has requested that soil vapor samples be collected and/or indoor air be monitored.

The draft guidance does not require the user to begin at Tier 1 and proceed stepwise through Tier 3. A site-specific Tier 3 assessment may be performed without previous evaluation. Additionally, the draft guidance allows the use of other technically sound approaches in evaluating the vapor intrusion pathway. Based on the site-specific conditions and considerations from the guidance indicated above, DOE and EPA have agreed to the following strategy for evaluation of the vapor intrusion pathway:

- DOE will sample soil vapor directly beneath the slab of the lowest floor or basement within a subject building;

- DOE will concurrently sample the groundwater monitoring well in closest proximity to the subject building that exhibited the most elevated concentrations of VOCs during the most recent sampling event to establish current conditions;

- Soil vapor concentrations of VOCs directly beneath the floor slab will be compared against site specific soil vapor trigger levels that have been agreed to by DOE and EPA Region 4;

- If the average concentrations of all VOCs in the soil vapor samples from beneath the building do not exceed their respective trigger levels, further evaluation of the vapor intrusion pathway will not be performed because the subslab concentrations are not considered to present any risk to potential receptors;

- If the average concentrations of any VOCs in the soil vapor samples from beneath the building exceed their respective trigger levels, indoor air samples will be collected at normal breathing zone height under normal working conditions from the basement or lowest floor of the subject building in order to determine if a pathway for exposure exists;

- An outdoor air sample will be obtained concurrent with the indoor air samples to identify any potential contribution of VOCs from external sources; and

- The data from the indoor air samples and outdoor air sample will be compared against 25-year industrial preliminary remediation goals (PRGs) to determine if any unacceptable risks are presented to potential receptors upon building transfer.

The overall objective of this SAP is to obtain data to assess the vapor intrusion pathway for Bldg. K-1007. In order to achieve this objective, sampling and analytical protocols followed under this Plan must ensure detection of volatile contaminants at levels at or below relevant risk screening criteria. For the groundwater sample (which is being collected to assess current conditions), the analytes that must be identified are those VOCs typically reported in the ETTP groundwater monitoring program. A preliminary set of analytes of interest for the vapor intrusion pathway for Bldg. K-1007 was identified as those VOCs historically detected in the nearby monitoring wells indicated in Fig. 3.1. This preliminary set of analytes of interest also includes the degradation (and parent) compounds of the detected VOCs. The preliminary list of analytes of interest for Bldg. K-1007 is provided in Table 5.1. Any VOCs that are currently analyzed by the groundwater program that are detected will also be reported.

For soil vapor samples, the sampling and analytical protocols must ensure that VOCs are quantified at levels at or below the levels that trigger indoor air sampling to further evaluate the potential risks associated with the vapor intrusion pathway. For ambient air (indoor and outdoor) samples, the sampling and analytical protocols must ensure that VOCs are quantified at or below the 25-year industrial PRGs. The 25-year industrial PRGs are the lower of the airborne concentrations corresponding to an ELCR of

10^{-5} or a hazard quotient of 0.1. Table 5.1 also provides the 25-year industrial PRGs for the preliminary set of analytes of interest.

Soil vapor action or trigger levels will inherently be larger than risk screening criteria due to the attenuation within the foundation materials and dilution effects as the vapors migrate into the indoor air volume of the buildings lowest floor. Therefore, detection and reporting limits for indoor air samples are suitable to meet the established objectives for soil vapor samples. Detection and reporting limits for the VOCs to be reported in groundwater, soil vapor, and ambient air samples are further identified in Chap. 7 of this SAP.

Table 5.1. Preliminary analytes of interest and respective indoor air PRGs[a] for the vapor intrusion pathway at Bldg. K-1007

Chemical	Industrial PRGs[b] (mg/m^3)
Carbon tetrachloride	3.58E-04
Chloroform	1.78E-03
Chloromethane	1.31E-02
1,1-Dichloroethane	7.31E-02
1,1-Dichloroethene	8.18E-04
1,2-Dichloroethene	4.60E-03
Cis-1,2-Dichloroethene	5.11E-03
Methylene chloride	8.67E-02
1,1,1-Trichloroethane	3.21E-01
Tetrachloroethene	7.05E-02
Trichloroethene	5.83E-03
Vinyl chloride	4.65E-03
Toluene	5.83E-02
Acetone	4.60E-01
2-Butanone	7.31E-01

[a] PRGs = Preliminary Remediation Goals.
[b] Industrial 25-year PRGs are the lower of the concentrations corresponding to an excess lifetime cancer risk of 10^{-5} or a hazard quotient of 0.1

5.2 SAMPLING DESIGN

To evaluate the potential for VOC intrusion into the ETTP buildings designated for transfer, the general sampling approach has been divided into two phases. The first phase involves collection of soil vapor samples from directly beneath the slab of the building's lowest floor. A groundwater sample will also be collected in the first phase of sampling. This groundwater sample will be collected from the upgradient monitoring well that has historically exhibited the most elevated concentrations of VOCs. Data obtained from the groundwater sample will be used to define current conditions and monitor for any future change in conditions. The second phase of sampling involves collection of indoor ambient air samples at the normal breathing zone height within the lowest floor of the subject building. An outdoor ambient air sample would also be collected in this second phase to identify any potential external sources that may contribute VOCs detected in the indoor air samples. The second phase of sampling would be implemented only if the soil vapor trigger levels were exceeded in the first phase samples.

5.2.1 Phase 1 – Sub-Slab Soil Vapor and Groundwater Sampling

During the first phase, seven soil vapor samples will be collected directly beneath the first floor or foundation slab of Bldg. K-1007. The VOC concentrations measured in these sub-slab soil vapor samples reflect equilibrium conditions resulting from attenuation in the soil column beneath the building. Samples taken in this fashion eliminate the uncertainty associated with partitioning calculations in modeling.

The seven sample stations for the sub-slab soil vapor samples will be located on the basis of best professional judgment. Sampling stations for Phase 2 indoor air samples will generally coincide with the locations selected for sub-slab soil vapor sampling. Therefore, the selection of sampling stations will attempt to avoid locations immediately adjacent to activities that may be fugitive VOC sources (such as lavatories or janitorial closets that may contribute VOCs from cleaners, floor stripping, indoor painting activities or industrial activities that use organic solvents). Additionally, the sampling stations will be located toward the building interior to avoid leakage of atmospheric air and the resulting dilution of soil vapor samples that may occur if sample stations are located near the building edge.

The soil vapor samples shall be collected by drilling a small (~ 9/16 in diameter) penetration through the first floor or foundation slab. If a vapor barrier is present beneath the floor slab, penetration of this barrier will be required. Otherwise, care shall be taken to avoid disturbance or penetration of the underlying soil or aggregate. Soil vapor samples shall be grab samples (sample collection duration of less than 60 seconds) collected using 5L pre-evacuated SUMMA canisters. The preliminary analytes for the soil vapor samples are identified in Table 5.1. Any VOCs that are currently analyzed by the groundwater program that are detected will also be reported.

A groundwater sample shall be collected concurrent with the soil vapor samples to determine current groundwater conditions. The groundwater sample shall be collected from the monitoring well in closest proximity to the subject building that exhibited the most elevated VOC concentrations in the most recent groundwater monitoring event. For Bldg. K-1007 the groundwater sample shall be collected from well BRW-043. This well will be purged and sampled using micropurging techniques to produce samples of lower turbidity. To be consistent with the groundwater program, samples will be analyzed for those VOCs typically reported under the ETTP groundwater monitoring program.

5.2.2 Phase 2 – Ambient Air Sampling

Phase 2 ambient air sampling will be performed for buildings scheduled for transfer only if VOC concentrations in the Phase 1 soil vapor samples from beneath the building exceed the site-specific soil vapor trigger levels. The site-specific soil vapor trigger levels are presented in Table 5.2.

Seven indoor air samples will be taken at 2 to 5 ft above the floor within the building. In order to ensure the samples are indicative of VOC concentrations within the building during normal operating or working conditions, all sampling activities will be conducted with the building heating, ventilation, and air-conditioning systems turned on. The sample stations for the seven indoor air samples will coincide with the locations selected for the sub-slab soil vapor samples. As indicated, the location of indoor air sampling stations will be selected to attempt to avoid locations immediately adjacent to activities that may introduce fugitive VOC emissions.

The indoor air samples will be collected using pre-evacuated (sub-atmospheric) pre-cleaned and certified 5L SUMMA canisters. Indoor air samples will be 8-h., time-weighted average samples. A minimum of one 8-h, time-weighted average ambient air sample will be collected outside of the building to exclude any potential contributions from external industrial sources. This outdoor sample station will be set up near the building at an upwind location. The location of the sampling station will be made by contacting

Table 5.2. Site-specific soil vapor trigger levels indicating the need for indoor air sampling

Volatile organic compound	Trigger level[a] (mg/m^3)	Concentration in building ($\mu g/m^3$)	Alpha[b]
1,1,1-Trichloroethane	3.01E+02	3.21E+02	1.07E-03
1,1,2,2-Tetrachloroethane	6.67E-01	7.05E-01	1.06E-03
1,1,2-Trichloroethane	1.91E+00	2.04E+00	1.07E-03
1.1.2-Trichloro-1,2,2-trifluoroethane	4.04E+03	4.38E+03	1.08E-03
1,1-Dichloroethane	6.88E+01	7.31E+01	1.06E-03
1,1-Dichloroethene	7.55E-01	8.18E-01	1.08E-03
1,2-Dichloroethane	1.43E+00	1.57E+00	1.10E-03
1,2-Dichloroethene	3.95E+00	4.60E+00	1.16E-03
1,2-Dichloropropane	5.45E-01	5.83E-01	1.07E-03
2-Butanone	6.84E+02	7.31E+02	1.07E-03
2-Hexanone	na[c]	na[c]	1.04E-03
4-Methyl-2-pentanone	4.06E+02	4.38E+02	1.08E-03
Acetone	4.13E+02	4.60E+02	1.11E-03
Benzene	4.05E+00	4.38E+00	1.08E-03
Bromodichloromethane	2.62E+00	2.38E+00	9.11E-04
Bromoform	1.39E+01	1.02E+01	7.38E-04
Bromomethane	6.89E-01	7.31E-01	1.06E-03
Carbon disulfide	9.31E+01	1.02E+02	1.10E-03
Carbon tetrachloride	3.35E-01	3.58E-01	1.07E-03
Chlorobenzene	2.75E+00	2.92E+00	1.06E-03
Chloroethane	1.38E+03	1.46E+03	1.06E-03
Chloroform	1.62E+00	1.78E+00	1.10E-03
Chloromethane	1.24E+01	1.31E+01	1.06E-03
cis-1,2-Dichloroethene	4.81E+00	5.11E+00	1.06E-03
cis-1,3-Dichloropropene	2.80E+00	2.92E+00	1.04E-03
Dibromochloromethane	1.26E+01	1.02E+01	8.11E-04
Ethylbenzene	3.49E+01	3.72E+01	1.06E-03
Methylene chloride	7.92E+01	8.67E+01	1.09E-03
Styrene	1.38E+02	1.46E+02	1.06E-03
Tetrachloroethene	6.66E+01	7.05E+01	1.06E-03
Toluene	5.39E+01	5.83E+01	1.08E-03
trans-1,2-Dichloroethene	9.67E+01	1.02E+02	1.06E-03
trans-1,3-Dichloropropene	4.91E+00	5.11E+00	1.04E-03
Trichloroethene	5.45E+00	5.83E+00	1.07E-03
Vinyl chloride	4.23E+00	4.65E+00	1.10E-03

[a]Proposed trigger level is the result of selecting a soil gas concentration that results in an indoor air concentration equal to the PRG. Note that these are still under negotiation with Region 4 of EPA.

[b]Alpha is the infinite source indoor attenuation coefficient and directly correlates the soil gas concentration with the indoor air concentration.

[c]na = not available due to lack of toxicity data.

mg/m^3 = milligram per cubic meter.

$\mu g/m^3$ = microgram per cubic meter.

the Park Shift Superintendent's (PSS) Office to acquire wind direction from the site meteorological station. The sampling station shall be located no more than 20 ft from the building at a location that will be minimally impacted by facility operations (i.e., high-traffic areas shall be avoided to the extent possible). The final location of this sampling station shall be determined in the field during sampling activities.

6. FIELD SAMPLING PLAN

Soil vapor and ambient air sampling activities at K-1007 will be implemented in two separate mobilization events. Prior to each mobilization event the sampling subcontractor (SSC) will obtain evacuated 5L SUMMA canisters that have been cleaned, conditioned and certified in accordance with the requirements of Method TO-15. Other sampling system components shall be cleaned in accordance with Method TO-15 prior to assembly of the sampling system. Non-metallic parts shall be rinsed in deionized water and dried in a vacuum at 50° C. Stainless steel parts and fittings shall be cleaned in an ultrasonic bath using methanol followed by ultrasonic cleaning in hexane. These parts shall be subsequently rinsed in deionized water and baked in a vacuum oven at 100° C for 12 to 24 hours.

During the first phase of sampling, soil vapor samples will be collected from directly beneath the first floor slab of the building. A groundwater sample will also be collected from monitoring well BRW-043 during the first phase of sampling. The data from the upgradient groundwater sample will be used to assess current conditions and provide a basis for monitoring changes in subsurface conditions in the future.

The sampling systems for soil vapor shall be 5L subatmospheric SUMMA canisters. For collection of the soil vapor samples, flow restriction will be provided by a critical orifice set to charge the canisters to the desired end pressure over a 60 second sample collection period. The sampling systems shall be assembled in accordance with Fig. 1 of Method TO-15 prior to mobilization to the field.

Seven sub-slab soil vapor samples shall be collected during the sampling event at locations shown in Fig. 6.1. A penetration permit may be required for installation of the sub-slab sample ports. Floor penetrations shown in Fig. 6.1 are approximate only and must be field located prior to installation based upon the requirements of the penetration permit. It should be noted that sample stations 1, 2, 3, 4 and 7 will require penetration of suspected Category I Asbestos Containing Material. Sample stations 5 and 6 are located in areas with a raised floor above the slab. The space between the raised floor and slab contains electrical power cables, HVAC ductwork and piping for an inoperable Halon fire suppression system. Field location of stations 5 and 6 will be necessary. Prior to penetration of the floor slab, the sampling system shall be located at the stations indicated in Fig. 6.1. Once the sampling system has been set up at the designated locations, the SSC shall record temperature, humidity, and other parameters indicated by Method TO-15. The inlet tubing to the sampling system shall be as short as possible. Samples will be taken by drilling small (~9/16-in.-diam) holes through the slab taking care not to disturb the materials underlying the slab. If a vapor barrier is part of the design, penetration of this barrier will be required. Consistent with EPA guidance, a capped brass or stainless steel tube will be inserted into the penetration. Immediately upon completion of the penetration, it will be sealed using non-VOC-bearing caulk. After completion of the penetration, the cap shall be removed from the stainless tube to attach the inlet tubing for the sampling system. The inlet line of the sample system shall be attached to the floor penetration tube and the flow valves opened.

Upon collection of the air samples, the SUMMA canisters shall be valved closed. The sampling line shall be disconnected from the canister and the canister removed from the sampling system. Upon collection of the samples, the final pressure shall be checked and recorded. The final system pressure should be ~ 88 Kpa (~90-100 torr vacuum).

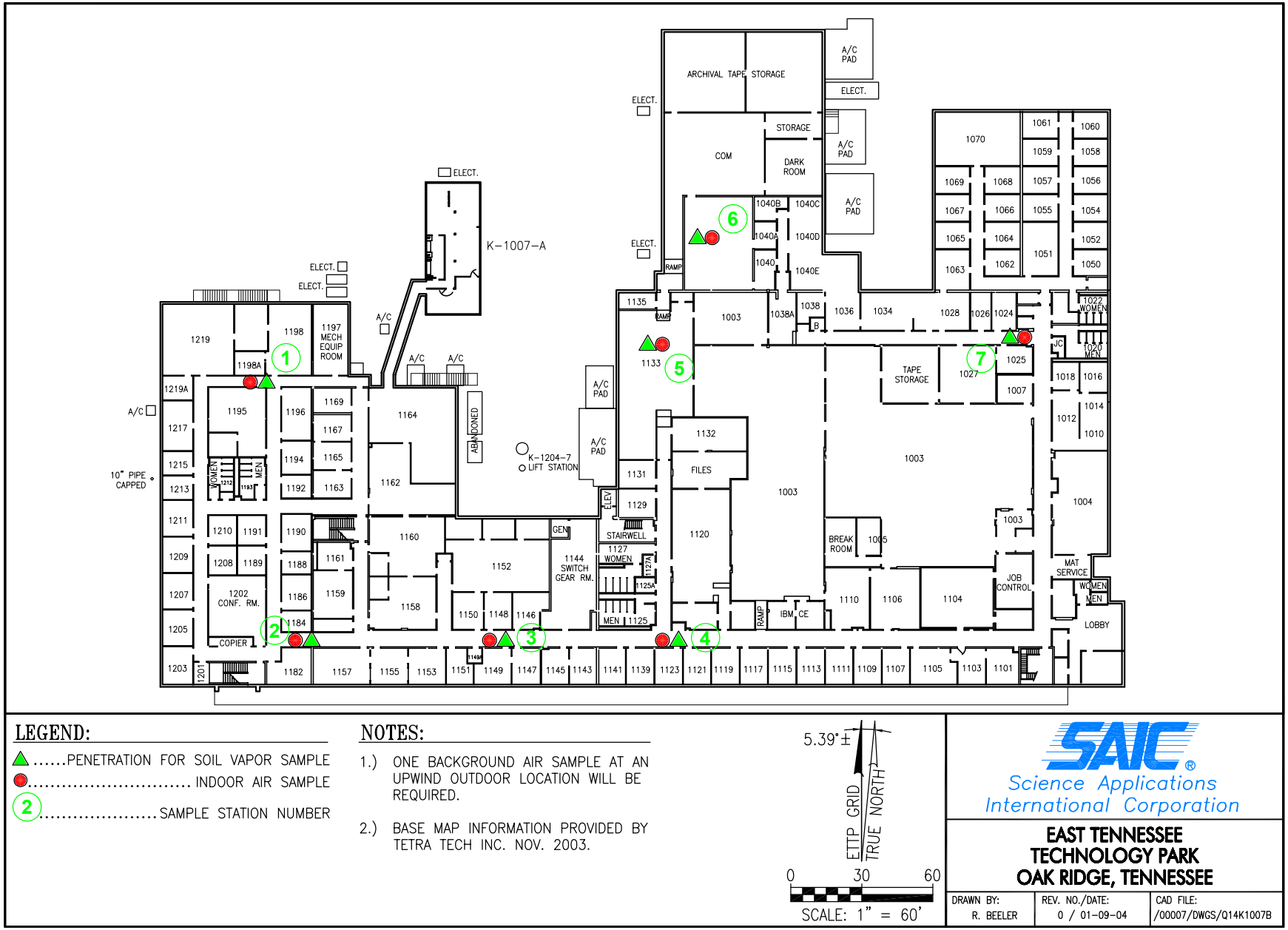

Fig. 6.1. Building K-1007 soil vapor and indoor air sampling stations.

Upon collection of the SUMMA canister, it shall be labeled as required by the SSC's standard operating procedures (SOPs). The canisters shall be shipped to the laboratory in a canister shipping case as required by the manufacturer's specifications or the SSC's SOPs.

Decontamination of sampling equipment used for collection of air samples is not required. All equipment, including the sampling inlet line, used at each sampling station shall be dedicated.

Groundwater samples shall be collected from well BRW-043 using micropurging techniques. The SSC shall locate the sampling equipment at the indicated well and place sufficient plastic sheeting around the well to prevent cross contamination. The sampling pump should be of stainless steel construction fitted with Teflon bladders and Teflon-lined polyethylene tubing. The SSC should ensure that the Micropurge Water Analyzer and Flow Cell are calibrated in accordance with the manufacturers instructions. In order to collect the groundwater sample, the well should be opened and the headspace monitored for organic vapors using a photoionization detector. Water levels in the well should be measured using an electronic level indicator. After determination of the water level, the pump should be inserted to the midpoint of the water column or midpoint of the screen as required by the SSC SOPs. The water level indicator should subsequently be reinserted and purging should be initiated. The purge rate should be adjusted to maintain the static water level in the well. Purging should continue until the parameters of temperature, pH and specific conductance have stabilized and the turbidity has reached the desired end point (usually 5-10 nephelometric turbidity units). Sampling should be conducted immediately after the well has been purged by re-directing the flow through cell to the specified sample containers.

If the average concentrations of any of the VOCs detected in the soil vapor samples from beneath the floor slab exceed their site-specific trigger levels, indoor air samples will be collected in a second phase of sampling. Indoor air samples shall be collected at the same sample stations indicated for the soil vapor samples in Fig. 6.1. The sampling systems for the indoor air samples shall be cleaned, conditioned, and certified in accordance with Method TO-15 prior to mobilization. Sampling systems for indoor air samples should be assembled prior to field mobilization as previously described. In order to collect the indoor air samples, the sampling systems shall be located at the stations depicted in Fig. 6.1 with the inlet suspended 3 to 5 ft above the floor surface. Once the sampling system has been set up at the designated locations, the SSC shall record temperature, humidity, and other parameters indicated by Method TO-15.

Flow restriction for the indoor air samples shall be provided by an electronic mass flow controller as described by Method TO-15. A practice canister, as described in Method TO-15, shall be used to verify the system fill rate and absence of leakage prior to collecting the ambient air samples. The reading from the certified mass flow meter should be within ±10% of the reading from the system's mass flow controller. If the values are in disagreement, the system should be checked for leakage, the mass flow controller recalibrated, or the sampling system replaced. After adjustment of the canister flow rate to the proper value, the sampler should be turned off and the practice canister disconnected from the system. A clean certified canister shall be attached to the system for sampling and the system valves opened. The system timer shall be set to start and stop the sampling period at the appropriate times.

An outdoor ambient air sample will be collected in Phase 2 to identify any contribution of VOCs from fugitive sources. Outdoor air samples shall be collected at a location determined in the field by the SSC. This location shall be recorded on a map in the SSC field logbook. Outdoor air samples will also be collected with subatmospheric 5L SUMMA canisters that have been cleaned, conditioned and certified in accordance with Method TO-15. To collect the outdoor air sample, the SSC shall set up the sampling system at the field determined location. The inlet for the outdoor air sample shall be suspended ~ 5 ft above ground surface. Flow restriction for the outdoor ambient air sample will be provided by an electronic mass flow controller and magnelatch valve as described by Method TO-15. As described above for indoor air samples, a practice canister shall be used to verify the system fill rate and absence of

leakage prior to actual sample collection. Once the system has been determined to be leak tight and properly calibrated, a clean certified canister shall be attached to the system for sampling, the system valves opened, and the timer set for initiating the sampling period.

The only field quality control (QC) samples required for the soil vapor and air samples are field equipment blanks and a duplicate. These QC samples are required only for the second sampling event. A field blank shall be required for groundwater sampling. All samples shall have the appropriate radiological analyses performed to comply with shipping protocols.

Sample container, preservation and holding time requirements are summarized in Table 6.1.

7. ANALYTICAL REQUIREMENTS

Air samples shall be quantitated for VOCs using gas chromatography/mass spectrometry (GC/MS) analyses as required by Method TO-15. Any of the VOCs indicated in Table 7.1 that are detected shall be reported. Additionally, the laboratory shall report up to twenty tentatively identified components (TICs). Quantitation of VOCs in air samples shall meet the reporting and detection limits specified in Table 7.1. Groundwater samples shall be quantified by GC/MS per Method OLM 03.1 VOA. Analyses of groundwater samples shall meet the reporting limits specified in Table 7.2. Additionally, the laboratory shall report up to twenty TICs in the groundwater sample.

8. DATA MANAGEMENT AND REPORTING

Data obtained from this sampling event shall be managed in accordance with the requirements of the *Data Management Implementation Plan for the Reindustrialization Program, Oak Ridge, Tennessee* (BJC/OR-865). Results will be provided to EPA Region 4 and to the Tennessee Department of Environment and Conservation DOE-Oversight Office.

9. REFERENCES

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EPA (U. S. Environmental Protection Agency) 1999. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)*, Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January.

EPA (U. S. Environmental Protection Agency) 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*, EAP530-F-052, November.

Table 6.1. Sample container, preservation, and holding time requirements

Event	Sample Number[a]	Sample type	Parameters of concern	Analytical protocols	Container type/volume	Preservation	Holding time
01	AU-01-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-02-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-03-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-04-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-05-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-06-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-07-41-1007-V	Soil vapor-grab	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
01	AU-00-41-1007-W	Groundwater	Volatile organics[b]	OLM03.1VOA	3×40 ml VOA vials	HCl to pH < 2: Cool 4° C	14 days
01	AU-93-41-1007-B	Field Blank	Volatile organics[b]	OLM03.1VOA	3×40 ml VOA vials	Prepreserved	14 days
02	AU-01-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-02-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-03-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-04-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-05-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-06-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-07-42-1007-I	Indoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-07-42-1007-D	Indoor Air Duplicate: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-08-42-1007-A	Outdoor Air: 8 hr TWA[c]	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-91-42-1007-B	Air Field Blank	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days
02	AU-92-42-1007-B	Air field blank	Volatile organics[b]	TO-15	5L SUMMA Canister	None	14 days

[a]Sample station nomenclature is AU-AA-BC-DDDD-EE where the AA field is the station number 01-89. Sample station numbers 91 and 92 are dedicated for air field blanks. Station 93 is reserved for the groundwater field blank. The BC field designates the fiscal year and sampling event in that year. The DDDD field designates the building number. The EE field designates the sample type where V = soil vapor; I = indoor air; A = outdoor air; B = blank; D = duplicate; and W = groundwater.

[b]Volatile organics of concern for air sampling at K-1007 include tetrachloroethene; trichloroethene; 1,2-dichloroethene; vinyl chloride; 1,1,1-trichloroethane; 1,1-dichloroethene; 1,1-dichloroethane; carbon tetrachloride; chloroform; methylene chloride; chloromethane; toluene; acetone; and 2-butanone.

[c]TWA = time-weighted average.

Table 7.1. VOCs and their respective quantitation and detection limits for soil vapor and air sampling

Analyte	Analytical method	Air quantitation level (mg/m^3)[a]	Air detection level (mg/m^3)
1,1,1-Trichloroethane	TO-15	3.21E-01	3.21E-02
1,1,2,2-Tetrachloroethane	TO-15	7.05E-04	7.05E-05
1,1,2-Trichloroethane	TO-15	2.04E-03	2.04E-04
1,1,2-Trichloro-1,2,2-trifluoroethane	TO-15	4.38E-00	4.38E-01
1,1-Dichloroethane	TO-15	7.31E-02	7.31E-03
1,1-Dichloroethene	TO-15	8.18E-04	8.18E-05
1,2-Dichloroethane	TO-15	1.57E-03	1.57E-04
1,2-Dichloroethene	TO-15	4.60E-03	4.6E-04
1,2-Dichloropropane	TO-15	5.83E-04	5.83E-05
2-Butanone	TO-15	7.31E-01	7.31E-02
3-Hexanone	TO-15	na[b]	na[b]
4-Methyl-2-pentanone	TO-15	4.38E-01	4.38E-02
Acetone	TO-15	4.60E-01	4.6E-02
Benzene	TO-15	4.38E-03	4.38E-04
Bromodichloromethane	TO-15	2.38E-03	2.38E-04
Bromoform	TO-15	1.02E-02	1.02E-03
Bromomethane	TO-15	7.31E-04	7.31E-05
Carbon disulfide	TO-15	1.02E-01	1.02E-02
Carbon tetrachloride	TO-15	3.58E-04	3.58E-05
Chlorobenzene	TO-15	2.92E-03	2.92E-04
Chloroethane	TO-15	1.46E+00	1.46E-01
Chloroform	TO-15	1.78E-03	1.78E-04
Chloromethane	TO-15	1.31E-02	1.31E-02
cis-1,2-Dichloroethene	TO-15	5.11E-03	5.11E-04
cis-1,3-Dichloropropene	TO-15	2.92E-03	2.92E-04
Dibromochloromethane	TO-15	1.02E-02	1.02E-03
Ethylbenzene	TO-15	3.72E-02	3.72E-03
Methylene chloride	TO-15	8.67E-02	8.67E-03
Styrene	TO-15	1.46E-01	1.46E-02
Tetrachloroethene	TO-15	7.05E-02	7.05E-03
Toluene	TO-15	5.83E-02	5.83E-03
trans-1,2-Dichloroethene	TO-15	1.02E-01	1.02E-02
trans-1,2-Dichloropropene	TO-15	5.11E-03	5.11E-04
Trichloroethene	TO-15	5.83E-03	5.83E-04
Vinyl chloride	TO-15	4.65E-03	4.65E-04
Xylenes (total)	TO-15	1.46E-02	1.46E-03

[a] mg/m^3 = milligram per cubic meter.
[b] na = no toxicity data available.

Table 7.2 VOCs to be reported and their respective quantitation limits for groundwater

Analyte	Analytical method	Groundwater quantitation level (µg/L)[a]
1,1,1-Trichloroethane	OLM03.1VOA[b]	5
1,1,2,2-Tetrachloroethane	OLM03.1VOA	5
1,1,2-Trichloroethane	OLM03.1VOA	5
1,1-Dichloroethane	OLM03.1VOA	5
1,1-Dichloroethene	OLM03.1VOA	5
1,2-Dichloroethane	OLM03.1VOA	5
1,2-Dichloroethene	OLM03.1VOA	5
1,2-Dichloropropane	OLM03.1VOA	5
2-Butanone	OLM03.1VOA	10
3-Hexanone	OLM03.1VOA	10
4-Methyl-2-pentanone	OLM03.1VOA	10
Acetone	OLM03.1VOA	10
Benzene	OLM03.1VOA	5
Bromodichloromethane	OLM03.1VOA	5
Bromoform	OLM03.1VOA	5
Bromomethane	OLM03.1VOA	10
Carbon disulfide	OLM03.1VOA	5
Carbon tetrachloride	OLM03.1VOA	5
Chlorobenzene	OLM03.1VOA	5
Chloroethane	OLM03.1VOA	10
Chloroform	OLM03.1VOA	5
Chloromethane	OLM03.1VOA	10
cis-1,2-Dichloroethene	OLM03.1VOA	5
cis-1,3-Dichloropropene	OLM03.1VOA	5
Cibromochloromethane	OLM03.1VOA	5
Ethylbenzene	OLM03.1VOA	5
Methylene chloride	OLM03.1VOA	5
Styrene	OLM03.1VOA	5
Tetrachloroethene	OLM03.1VOA	5
Toluene	OLM03.1VOA	5
trans-1,2-Dichloroethene	OLM03.1VOA	5
trans-1,2-Dichloropropene	OLM03.1VOA	5
Trichloroethene	OLM03.1VOA	5
Vinyl chloride	OLM03.1VOA	2
Xylenes (total)	OLM03.1VOA	5

[a]µg/L = microgram per liter.
[b]OLM = organic laboratory method, EPA Contract Laboratory Program.
VOA = volatile organic analysis.

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APPENDIX D

RADIOLOGICAL SURVEY PLAN FOR THE K-1007 BUILDING

1. AREA TO BE SURVEYED

The areas to be surveyed are the K-1007 building (interior and exterior surfaces) and the K-1007-A canteen trailer, which are to be transferred to the Community Reuse Organization of East Tennessee (CROET). No exterior laydown, parking, or soil areas are associated with this footprint. The K-1007 building has been primarily used for office space and support services and has two floors (72,413 ft^2 on the first floor and 39,703 ft^2 on the second floor). The K-1007-A canteen trailer has been used as a lunchroom and is 1344 ft^2 in size, not including the covered walkway from K-1007 to K-1007-A.

2. HISTORY OF THE AREA

The area where the K-1007 building is located was farmland prior to the construction of the Oak Ridge Gaseous Diffusion Plant (ORGDP), later known as the K-25 Site. In the early 1940s, prior to the construction of Bldg. K-1007, numerous warehouses and maintenance buildings used to support the construction of ORGDP occupied the present K-1007 area. These buildings were demolished by the late 1950s, and the area was maintained as a grassy field. The original K-1007 building was built in 1960 with additions added in 1966, 1972, 1974, 1978, and 1984 to create the present facility. Since K-1007 was built in 1960, it has provided office and work space for the staff and equipment of Computer Operations, User Services and Systems Support, Technical Applications, Office of the Controller, Management Information Systems, and the Office of the Treasurer. Other key operations included data entry, micrographics processing, storage of electronic media, and control of production programs. A darkroom with specialized equipment for transferring computer media to microfilm and an associated mercury-extracting unit supported the computer operations. Two satellite accumulation areas were located in Room 1003 for the accumulation of mercury and used fluorescent light bulbs. These areas were closed in July 1998. Portions of the building were leased to CROET in 1998 as part of the Reindustrialization Program. The K-1007 building has always been outside the East Tennessee Technology Park (ETTP) Radiologically Controlled Area but, at one time, did have its own security fencing.

Radiological contamination, if present, is expected to be a small percentage of the U. S. Department of Energy (DOE) surface contamination limits due to the results of the prior surveys performed in the area. These results are discussed below. In general, no contamination was found within the area that exceeded the DOE limits, with the exception of a wheeled cart that was subsequently moved to a contamination area in another building on-site.

3. EXISTING SURVEY DATA SUMMARY

A search of the Bechtel Jacobs Company LLC (BJC) Radiation Control (RADCON) electronic survey data collected since 1996 revealed that 14 area surveys were performed in, or on, the building, including 6 surveys that covered the entire roof area. A review of these surveys provided the basis for the survey classification of the individual survey units.

Four surveys were conducted on the second floor during March and April 1996 because of the presence of declared pregnant workers. No elevated readings were detected in the offices (Rooms 2326, 2210, and 2005) or the women's restrooms (Rooms 2214 and 2372) except for the beta-gamma direct (total) readings on the floors of the restrooms, which ranged from 1300 to 2700 disintegrations per minute (dpm)/100 cm^2 and 1100 to 1900 dpm/100 cm^2 in Rooms 2214 and 2372, respectively. The elevated readings are attributed to the floors being made of glazed clay tiles, which have naturally occurring radioactive materials (NORM)

in their clay matrices. The maximum removable alpha contamination detected was 117 dpm/large area wipe (LAW[22]); maximum beta-gamma removable contamination was 884 dpm/LAW (no actual smear surveys over 100-cm^2 areas were performed). Gamma radiation levels ranged from 4 to 18 μR/h (4 to 17 μrem/h). It was noted on the survey documentation for Room 2005 that a radium dial clock was found on the wall and that the supervisor was notified to remove the clock from the site (no radiological readings were recorded by the technician). The clock is currently not in the room (as verified during a walkdown of the facility conducted on May 20, 2002).

A small, gray handcart was found with a contaminated wheel in the mechanical equipment room on the second floor in May 1998, during a building spot-check survey (6732 dpm/100 cm^2 total beta-gamma maximum reading; no total alpha or removable contamination was detected). The handcart was taken to Bldg. K-1401 and placed in a contamination area. The remainder of the facility had no detectable contamination distinguishable above background levels. No measurements of the ambient gamma radiation levels were taken for the spot-check surveys.

The roof area (including equipment) was surveyed in May 1998 with hand-held contamination meters as well as with a sodium iodide (NaI) gamma detector. No total or removable activity was found above background levels except where the brick wall was surveyed. No areas were found that were greater than twice the NaI ambient background level. The maximum reading was 2040 dpm/100 cm^2 total beta-gamma, which is attributed to the NORM found within red clay bricks' matrix.

4. DATA QUALITY OBJECTIVES/PURPOSE

The purpose of this survey plan is to obtain radiological survey data to determine the presence of residual contamination in the area through the usage of a scoping survey. The data gathered, combined with the historical data, will be used to transfer title of the K-1007 building and K-1007-A trailer to CROET.

5. MEASUREMENT TECHNIQUES/SURVEY APPROACH

5.1 RADIONUCLIDES OF CONCERN

Process history of the ETTP site indicates that uranium (natural, depleted, and/or enriched uranium) would be the most prominent radiological contaminant potentially present in the K-1007 building due to tracking of contamination from other on-site buildings. Uranium-235 enrichment levels expected from operations since the early 1960s would be anticipated to be between 0.2 to 5.0%. Most facilities would be potentially contaminated via tracking from enrichments of less than 3%.[23] However, as this has been an administrative building throughout its history, it is assumed that the uranium would be from natural sources and the enrichment is approximately that of natural uranium, 0.72%.

Other radionuclides (^{60}Co, ^{137}Cs, $^{89/90}Sr$, ^{237}Np, ^{99}Tc, and $^{238/239/240}Pu$) have also been detected on-site at ETTP. These other radionuclides originated from the introduction of contaminated materials from Oak Ridge National Laboratory and/or from the Hanford and Savannah River reactor returns uranium reprocessing program; however, these radionuclides are expected to be found in much lower quantities than uranium and undetectable in this area, based upon its operational history as an administrative facility.

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[22]A large area wipe (LAW) is normally taken over an area of approximately 1 m^2 (100 separate 100-cm^2 areas).
[23]Contracted Health Physics Technician Training handouts, K-25 Site, 1993.

If they were present, it is assumed that they would be present at ratios of 1140:1 for uranium to transuranic (U:TRU) and 350:1 for uranium to technetium-99 (U:^{99}Tc) [both ratios are process buildings weighted averages].[24]

5.2 DETERMINATION OF THE RESIDUAL RADIOACTIVITY LIMITS (DCGLS)

The overall goal of this survey is to show that residual contamination exceeding the release criteria is not present in each of the survey units. As shown by modeling, the dose and risk obtained from exposure to radioactivity at the DOE surface contamination limits, as set forth in Title 10 *Code of Federal Regulations* (*CFR*) 835[25] and also in DOE Order 5400.5,[26] is less than that from the dose and risk criteria, as explained in the Design of Radiological Surveys document[27] (hereafter referred to as the "design document"). As a result of this modeling, the derived concentration guideline levels (DCGLs) for this survey will be set at the DOE contamination limits for uranium (see Table 1 in this appendix), which is the dominant contaminant present on-site. A separate limit for the maximum allowable contamination that is concentrated in a smaller area, the derived concentration guideline level$_{\text{elevated measurement comparison}}$ ($DCGL_{EMC}$), is normally calculated based upon modeling the dose obtained from an area determined by the number of samples taken in the survey unit and the spacing between them. However, the $DCGL_{EMC}$ will be set to three times the appropriate contamination limit, which equates to the contamination averaging criteria as set forth by DOE in 5400.5 for an elevated reading within a 1 square meter (m^2) maximum size area.

Table 1. Contamination limits (DCGLs) for all survey units

	DCGL (dpm/100 cm^2)	$DCGL_{EMC}$ (dpm/area)
Total alpha	5000	15,000
Removable alpha	1000	N/A
Total beta-gamma	5000	15,000
Removable beta-gamma	1000	N/A

DCGL = derived concentration guideline level.
$DCGL_{EMC}$ = derived concentration guideline level$_{\text{elevated measurement comparison}}$
N/A = not applicable.

5.3 IDENTIFICATION OF SURVEY UNITS AND CLASSIFICATIONS

Areas are classified as either Class 3, 2, or 1 based upon historical data and process knowledge.

Survey units must be of the same or similar material type—for example, a survey unit cannot contain both asphalt and soil. It would be divided into a survey unit of asphalt and another survey unit of soil. Refer to the design document for complete descriptions of the different classifications of survey units. In general, a Class 3 survey unit is not expected to have residual radioactivity levels above 25% of the DCGL (1250 dpm/100 cm^2 total activity or 250 dpm/100 cm^2 removable activity). A Class 2 survey unit

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[24]*Isotopic Distribution of Contamination Found at the U. S. Department of Energy Gaseous Diffusion Plants*, Science Applications International Corporation (SAIC) report delivered to Bechtel Jacobs Company LLC, SAIC document number 143.19991103.002, October 1999.

[25](*CFR* 1999). 10 *Code of Federal Regulations*, entitled *Occupational Radiation Protection*; the values are taken from Appendix D, "Surface Radioactivity Values."

[26]DOE Order 5400.5 is entitled *Radiation Protection of the Public and the Environment*; the values are taken from Fig. IV-1, "Surface Contamination Guidelines."

[27]BJC 2000, *Design of Radiological Surveys of Potential Lease Space at East Tennessee Technology Park, Oak Ridge, Tennessee*, BJC/OR-554, Bechtel Jacobs Company LLC, Oak Ridge, TN.

is expected to have residual radioactivity levels less than the DCGL. A Class 1 survey unit is expected to have residual radioactivity levels above the DCGL. Based upon the existing survey data for the facility, excluding the NORM clay tiles readings obtained in the restrooms, all areas are initially classified as Class 3 areas. The K-1007 building will be composed of a total of 28 Class 3 survey units, as shown in Table 2. See Fig. 1 in this appendix for the locations of the interior survey units (ISUs) and Fig. 2 in this appendix for the exterior survey units (ESUs).

Table 2. Survey units classification

Area	Class	
	Interior areas	Exterior areas
K-1007, 1st floor, northeast corner (ISU 1)	Class 3	N/A
K-1007, 1st floor, east section (ISU 2)	Class 3	N/A
K-1007, 1st floor, southeast corner (ISU 3)	Class 3	N/A
K-1007, 1st floor, south computer rooms (ISU 4)	Class 3	N/A
K-1007, 1st floor, north computer rooms (ISU 5)	Class 3	N/A
K-1007, 1st floor, central (Payroll area) [ISU 6]	Class 3	N/A
K-1007, 1st floor, west central (ISU 7)	Class 3	N/A
K-1007, 1st floor, southwest corner (ISU 8)	Class 3	N/A
K-1007, 1st floor, northwest corner (ISU 9)	Class 3	N/A
K-1007, covered walkway to K-1007-A (ISU 10)	Class 3	N/A
K-1007-A (ISU 11)	Class 3	N/A
K-1007, 2nd floor, northeast corner (ISU 12)	Class 3	N/A
K-1007, 2nd floor, east central (ISU 13)	Class 3	N/A
K-1007, 2nd floor, west central (ISU 14)	Class 3	N/A
K-1007, 2nd floor, southwest corner (ISU 15)	Class 3	N/A
K-1007, 2nd floor, north of west central (ISU 16)	Class 3	N/A
K-1007, 2nd floor, northwest corner (ISU 17)	Class 3	N/A
K-1007 building exterior walls (entire wall) [ESUs 1 through 10]	N/A	Class 3
K-1007 building roof (ESU 11 – not pictured)	N/A	Class 3

ESU = exterior survey area.
ISU = interior survey area.
N/A = not applicable.

5.4 INSTRUMENTATION SELECTION AND SURVEY TECHNIQUES

Refer to the design document appendix for details on instrumentation selection. In general, alpha scintillation and beta-gamma Geiger-Müeller (GM) detectors will be attached to scalar ratemeters and will have minimum detectable activities less than 25% of the DCGL. Gas-proportional floor monitors or floor monitors with the probe detached from the monitor cart for usage as a hand-held probe, calibrated to detect both alpha and beta-gamma radiations, will be used for as much of the scan surveys as possible, including the primary work surfaces, walls, and ceilings. NaI meters and Bicron MicroRem® meters[28] will also be used, as specified in this survey plan. Removable contamination surveys (i.e., smear surveys) will be conducted at all locations where a fixed/total measurement is taken. All removable contamination survey smears will be counted on a gas-proportional counter calibrated to detect both alpha and beta-gamma radiations.

For Class 3 areas, 10% surface scan surveys will be performed over the primary traffic and work surfaces of the entire survey unit, as accessible. One hundred percent (100%) of the accessible floor area

[28]Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof.

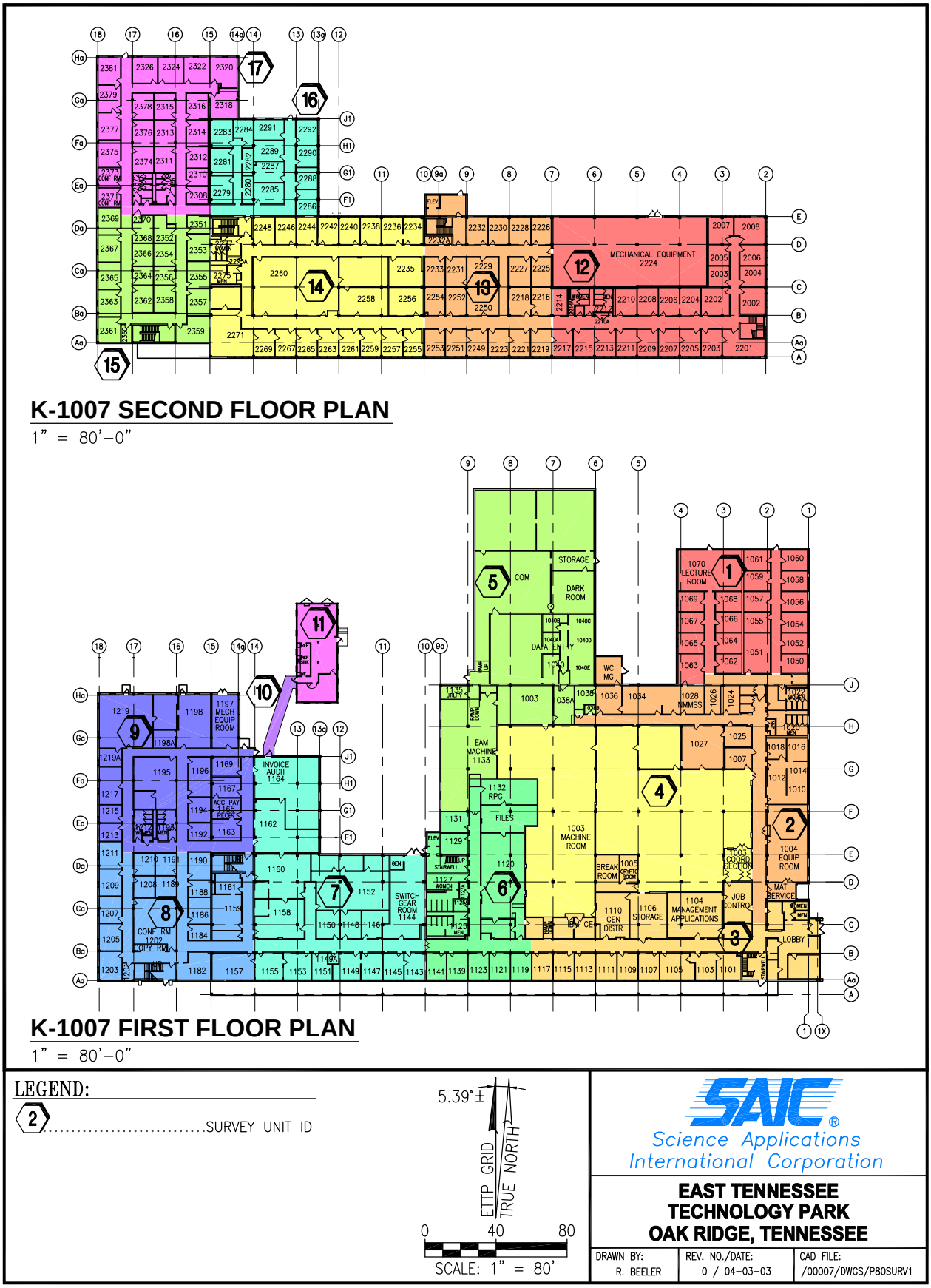

Fig. 1. K-1007 interior survey units.

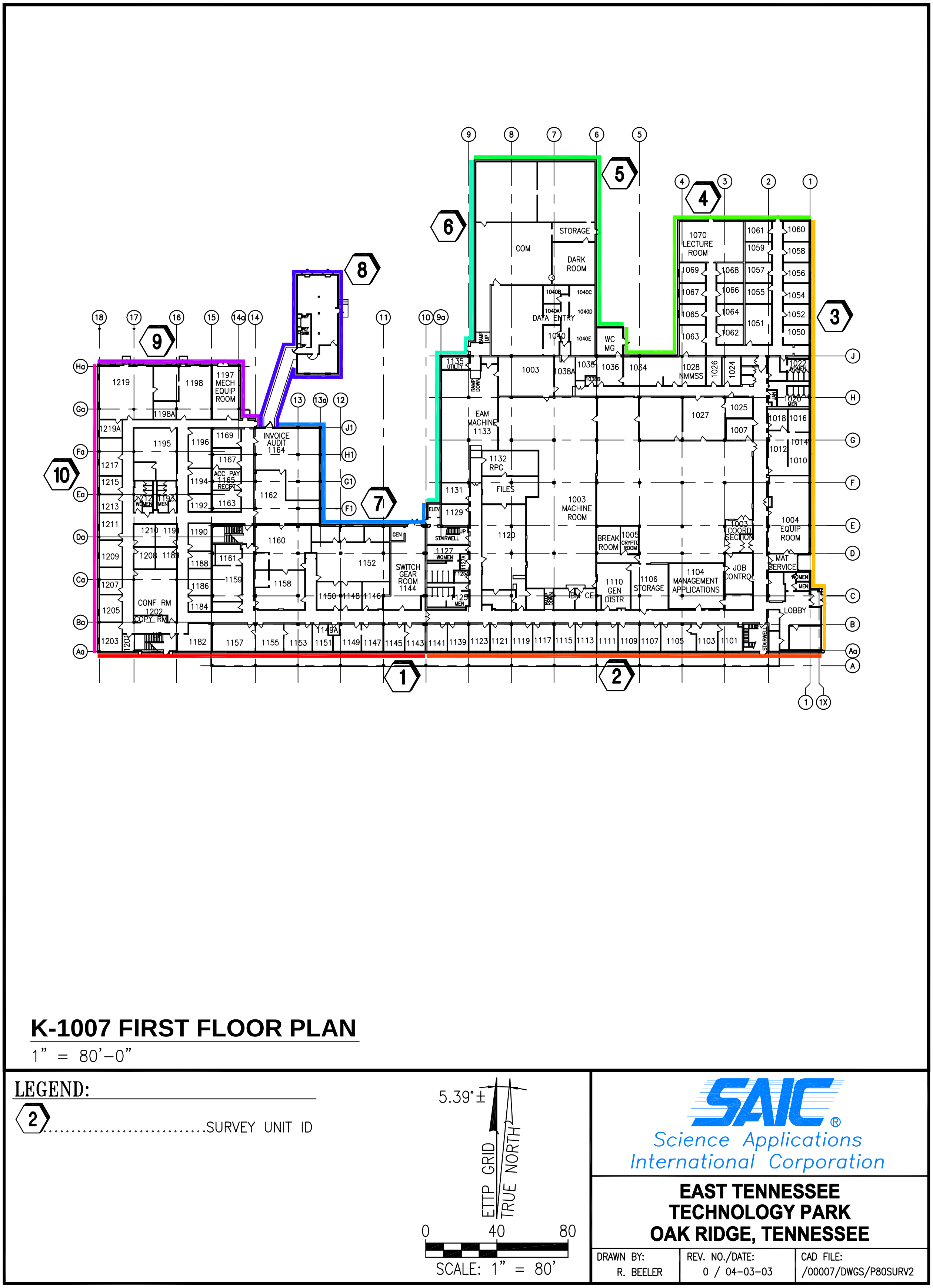

Fig. 2. K-1007 exterior survey units.

will be scanned in Class 2 areas. Other surfaces that are classified as Class 2 areas, such as walls, ceilings,overhead areas, etc., will have a scan coverage that varies in accordance with how close the expected activity levels are to the DCGLs (this is a deviation from the current design document but is in accordance with the proposed revision that has been submitted for approval). Class 1 survey units will have a 100% scan of all surfaces. Emphasis will be placed upon entrances/high-traffic areas, suspect areas, and professional judgment for all scan surveys. (Note: A 10% scan survey is not interpretable as surveying 100% of 10% of the offices in a particular survey unit and not performing any surveys in the other 90%; 10% of all floors, of all walls, and of all ceilings will be scanned, as accessible.)

All surveys will be performed in accordance with established BJC RADCON procedures (i.e., scan rate, probe distance, source checks, etc.).

5.5 AREA PREPARATION

All areas will be surveyed in an "as-found" condition. Materials may be rearranged or moved to allow for survey access to areas covered by material and/or equipment.

5.6 REFERENCE COORDINATE SYSTEM FOR SURVEY

Class 3 areas do not require a sample grid. A reference coordinate system will be used in each survey unit to reference measurements so they can be relocated/verified as needed, unless the measurement is at an easily identifiable location, such as "Room 1004, 4 ft up on west wall, ~2 ft from south wall." The starting point of the reference grid, if needed, will be the southwest corner of each survey unit, with the distance north being Y and the distance east being X in an X-Y coordinate system [i.e., (X,Y)], with the units in feet.

Class 2 and Class 1 survey units require a sample grid with systematic measurements taken based upon a random starting point. These survey grids are based upon the survey unit's area and number of systematic sample measurements required in each.

If a survey unit has to be reclassified to a higher classification and survey requirements, a revision to this survey plan will be issued containing the sample grids of the reclassified survey units.

6. SURVEY DESIGN

6.1 QUANTIFY DATA QUALITY OBJECTIVES

The null hypothesis (H_o) for each survey unit is that the residual contamination exceeds the DCGL. The alternative hypothesis (H_a) is that the survey unit meets the DCGL. Decision error levels, as set forth in the design document, are 0.05 for Type I (α) errors and 0.10 for Type II (β) errors in all survey units. The Lower Bound of the Gray Region (LBGR) is set to ½ of the DCGL. These parameters apply to all survey units, regardless of their classification. The design document discusses the data quality objective (DQO) process in greater detail.

6.2 DETERMINATION OF THE NUMBER OF DATA POINTS

Using the prescribed statistical testing methodology found in the design document (Sign test), a Δ/σ value (also known as the "relative shift") was computed (7.33) using the historical survey results, where Δ is the DCGL – LBGR, the LBGR is 50% of the DCGL, and σ is the standard deviation of the data. [Note: The majority of the readings were less than the instrument's Lc, the critical value at which there is 95% confidence that the value can be distinguished from background, or were recorded as "NEAD" (No Elevated Activity Detected); therefore, σ was assigned the value of the highest Lc value for the set of instruments divided by 1.65]. However, the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM)[29] recommends that the relative shift be between one and three, so the LBGR was adjusted to 80% of the DCGL (i.e., 4000 dpm/100 cm^2 total activity), resulting in a relative shift of 2.93. The increasing of the LBGR results in a smaller gray region, which is, "by definition, the concentration value at which the acceptable probability of failing a survey unit when it should pass is specified."[30] The Sign test was utilized, as the residual contamination present within the survey units should be at a very small fraction of the DCGL. For all survey units, 11 survey data points (fixed and removable readings) are needed, at a minimum, not including any tool, furniture, or equipment surveys.

6.3 SURVEY PROCEDURES

All surveys are to be performed in accordance with this survey plan, the design document, and BJC RADCON procedures.[31] Note: Survey technique is covered in the design document and will not be repeated in this plan. However, variations or clarifications of the design document will be included.

In any area where the survey indicates activity exceeding 5000 dpm/100 cm^2, direct alpha and beta-gamma measurements will be made following the establishment of a 1-m^2 grid to attempt to apply DOE Order 5400.5 release criteria. If, after applying DOE Order 5400.5 release criteria, the area or equipment still exceeds the guidelines, BJC RADCON procedures will be followed for posting of the immediate area. In addition, any contamination survey location found in excess of two times the DCGL will also have a dose rate measurement taken at a distance of 3 ft.

Any activity in excess of 25% of the DCGL will require that a Class 3 survey unit be reclassified as Class 2 and surveyed appropriately. Note: If the area exceeding 25% of the DCGL is on a glazed clay tile floor and is less than 3500 dpm/100 cm^2 total beta-gamma (or 2800 dpm/100 cm^2 total beta-gamma for a red clay brick[32]) with no alpha contamination above 25% of the DCGL, then no upgrading of the unit is required. This level of radioactivity is within that of the NORM contained in the glazed clay tile/brick matrix. Any activity in excess of the DCGL will require that a Class 3 or 2 survey unit be reclassified as Class 1 and surveyed appropriately. Notify the RADCON supervisor so the project radiological engineer can make any appropriate changes to this survey plan.

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[29](NRC 1997a). Nuclear Regulatory Commission, Nuclear Regulatory Guide (NUREG)-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Final Edition*, December 1997.

[30](NRC 1997b). Nuclear Regulatory Commission, Nuclear Regulatory Guide (NUREG)-1505, *A Proposed Nonparametrical Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys, Final Edition*, December 1997.

[31]Primarily SH-B-4012, "Radioactive Contamination Control and Monitoring," found in BJC-SH-04, Vol. I, *Radiation Protection Program.*

[32]Values computed based upon the beta-gamma background levels for brick and ceramic tile found in Table 5.1 of NUREG-1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, December 1997 (NRC 1997c), and an average beta-gamma Geiger-Müeller (GM) correction factor of 34 (dpm per 100 cm^2)/cpm for a planar radiation source.

6.3.1 Interior Survey Units

Any asbestos-controlled areas will be identified with any pertinent information on whether radiological contamination is suspected (i.e., ventilation hood, exhaust vents, posted radiological area, etc.) but not entered as part of this survey. No surveys will be performed above suspended ceiling tiles or under elevated flooring. Any ventilation exhausts and air intakes in the survey footprint will also be surveyed for contamination.

6.3.1.1 Class 3 interior survey units

Refer to Fig. 1 in this appendix for the first and second floor survey units. Ten percent of the primary traffic areas and work surfaces will be scanned with floor monitors and hand-held meters (including usage of a floor monitor probe set up as a hand-held probe and calibrated to detect alpha and beta-gamma contamination for large area scans of non-floor surfaces), as appropriate. Any location on the walls or ceiling that, using professional judgment, could potentially have residual radioactivity present will also be scanned over the suspected area and documented on the survey. Tools, office furniture, and equipment will be a separate survey unit and surveyed per the guidance found in Sect. 6.3.6. No removal of suspended ceiling tiles or floor panels will be required for this survey. Eleven measurements of total and removable contamination, at a minimum, will be recorded within each survey unit at locations determined during the scan survey to have the highest activity.

A general dose rate walkover survey of each survey unit, using a Bicron MicroRem® meter, will be performed to determine if any variations exist in the penetrating radiation dose rate. If variations exist, then the location, distance the dose rate was taken from the wall and/or floor, and dose rate at that location are to be recorded. Dose rate measurements will be obtained at a minimum of every 20 ft in hallways and large rooms.

6.3.1.2 Class 2 interior survey units

Although there are no Class 2 areas currently, the potential exists for having a Class 3 area upgraded to a Class 2. Class 2 survey protocols are as follows: 100% of the accessible floor surface will be scan surveyed using a floor monitor or hand-held meters, as appropriate; other surfaces (walls, overhead areas, and ceilings) will be scanned according to Table 3 in this appendix; and the measurement locations will be systematically chosen per the design document. Any Class 3 areas that exceed 25% of the DCGL will be reclassified as Class 2 areas and surveyed accordingly. All reclassified areas will be discussed in the revision to this survey plan and in the Environmental Baseline Survey (EBS) Chap. 6, "Survey Results."

Table 3. Class 2 Survey unit scan percentage versus percent of DCGL

% DCGL	Activity (dpm/100cm^2)	Scan %
<30%	<1500	10%
<50%	<2450	25%
<70%	<3450	50%
70%	<5000	100%

DCGL = derived concentration guideline level.
dpm = disintegrations per minute.

6.3.1.3 Class 1 interior survey units

While there are no Class 1 areas currently, the potential exists for having a Class 3 or 2 area upgraded to a Class 1. Class 1 survey units follow the Class 2 survey protocols, with the exception that all surfaces (not just accessible) are surveyed 100%. Any Class 3 or 2 areas that exceed the DCGL will be reclassified

as Class 1 areas and surveyed accordingly. All reclassified areas will be discussed in the revision to this survey plan and in the EBS Chap. 6, "Survey Results."

6.3.2 Exterior Survey Units

All exterior areas will be surveyed with hand-held meters or with a gas-proportional probe up to a minimum height of 8 ft. No exterior areas, other than the building exterior walls and roof, are covered under this survey plan. Emphasis is to be placed upon air vents/intakes, windowsills, gutter downspouts, and wherever professional judgment would indicate a higher probability of finding elevated readings.

6.3.2.1 Class 3 exterior survey units

Refer to Fig. 2 in this appendix for the exterior wall and roof survey units. Class 3 exterior surveys will have 10% of the accessible surfaces scanned with hand-held meters or with gas-proportional probes, as appropriate. Eleven measurements of total and removable contamination, at a minimum, will be recorded within each survey unit at locations determined during the scan survey to have the highest activity.

6.3.2.2 Class 2 exterior survey units

While there are no Class 2 areas currently, the potential exists for having a Class 3 area upgraded to a Class 2. Class 2 survey protocols are as follows: Walls, up to 8 ft, will be scan surveyed using hand-held meters and/or gas-proportional meters (if possible) according to the percentages listed in Table 3 in this appendix, and the survey measurement locations will be systematically chosen per the design document. Any Class 3 areas that exceed 25% of the DCGL will be reclassified as Class 2 areas and surveyed accordingly. All reclassified areas will be discussed in the revision to this survey plan and the EBS Chap. 6, "Survey Results."

6.3.2.3 Class 1 exterior survey units

Although there are no Class 1 areas currently, the potential exists for having a Class 3 or 2 area upgraded to a Class 1. Class 1 survey units follow the Class 2 survey protocols, with the exception that 100% of the accessible surface will be surveyed. Any Class 3 or 2 areas that exceed the DCGL will be reclassified as Class 1 areas and surveyed accordingly. All reclassified areas will be discussed in the revision to this survey plan and in the EBS Chap. 6, "Survey Results."

6.3.3 Equipment and Furniture (Furnishings) Surveys

The survey of equipment and furnishings will be performed along the lines of the survey protocol developed by Safety and Ecology Corporation (SEC) for the release of materials from the K-1001-A, -B, -C, and -D buildings prior to their demolition.[33] The K-1001-A, -B, -C, and -D and design document requirements that affect the number of survey data points are listed in Table 4 in this appendix.

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[33] *Survey Protocol Unrestricted Release of Building Furnishings*, prepared by Safety and Ecology Corporation (SEC) for Bechtel Jacobs Company LLC Radiation Control (RADCON).

Table 4. Comparison of parameters for computing number of samples

Parameter	SEC K-1001-A, -B, -C, and -D furnishings survey plan	Survey design document
Type I error rate (α)	0.05	0.05
Type II error rate (β)	0.05	0.10
Non-parametrical statistical test	Wilcoxon-Rank Sum (WRS)	Sign[34]
LBGR	2500 dpm/100 cm^2	4000 dpm/100 cm^2
Number of data points per survey unit	20 (10 in each survey unit, 10 in each reference background survey unit)	11

dpm = disintegrations per minute.
LBGR = Lower Bound of the Gray Region.
SEC = Safety and Ecology Corporation.

6.3.3.2 Furnishings – survey unit classifications and survey procedures

As stated in Sect. 5.3, survey units are classified as either Class 1, 2, or 3 based upon historical data and process knowledge providing information on the contamination potential for the unit. Furnishings (which includes all furniture, equipment racks, equipment, etc., for the purposes of this portion of the survey) are considered to have a low potential for residual contamination being present. All survey units will have NaI, alpha, and beta-gamma scan surveys performed on them, with the areas covered by the scans determined by professional judgment. In addition, direct and removable alpha and beta-gamma measurements will be taken, with the locations being the areas with the highest readings as determined during the scan surveys. A detailed listing of all the items within the survey unit is not required; a generalized item listing of survey unit classification and number, NaI scan results, and the individual survey data points is the minimum data reporting requirement.

Each building interior survey unit (ISU) [Table 2] is to be the basis for the furnishings survey unit (FSU); therefore, there is the potential for each building survey unit to have up to three different FSUs. The individual FSUs will be designated in a manner similar to the following example to identify the ISU and the FSU [e.g., ISU 4 FSU C3, which designates that the data are from the interior survey unit 4 (ISU 4) furnishings survey unit Class 3 (FSU C3)].

Class 3 Furnishings Survey Units

All newer furnishings will be grouped together in batches (survey units) and classified as Class 3, as they have a very low potential for having been used in other facilities or areas that are potentially contaminated. The total surface area of each Class 3 survey unit will not exceed 5000 m^2. The surface scan surveys will cover 5% of all accessible areas. If residual radioactive activity is found in excess of background levels (excluding radon), the item with the residual activity, and all items of a similar type and history in that survey unit, will be removed from that survey unit, reclassified as a separate Class 2 survey unit, and resurveyed accordingly.

Class 2 Furnishings Survey Units

Older furnishings, which may have been used in other buildings or areas, will be grouped into survey units and classified as Class 2. The total surface area of a Class 2 FSU will not exceed 1000 m^2. The surface scan surveys will cover 10% of all accessible areas. If residual radioactive activity is found in

[34]The WRS statistical test is for usage when the primary contaminants are found in background. The Sign test is to be used when the contaminant is not found in background or when the contaminants are in background, but at a small fraction of the DCGL. The Sign test will be used for this survey.

excess of the DCGL, the item with the residual activity, and all items of a similar type and history in that survey unit, will be removed from that survey unit, reclassified as a separate Class 1 survey unit, and resurveyed accordingly.

Class 1 Furnishings Survey Units

Only furnishings that have exceeded the Class 2 criteria, above, will be classified and surveyed as a Class 1 survey unit. The total surface area of a Class 1 FSU will not exceed 100 m^2. The surface scan surveys will cover 100% of all accessible areas.

All furnishings survey data results (in each survey unit) that meet the above criteria will be evaluated against the Sign test criteria to determine if the items can be released. The null hypothesis, H_o, to be tested is that the residual radioactivity in the survey unit exceeds the DCGL. If the null hypothesis is rejected based upon the non-parametrical statistical test, then the alternative hypothesis (H_a) is accepted, which states that the residual radioactivity in the survey unit does not exceed the DCGL and, therefore, can be released.

6.4 SPECIFICATION OF SAMPLING LOCATIONS

All recorded survey measurement locations are to be on a judgmental basis for Class 3 survey units, per the design document, and should include entrances, primary traffic areas, air vents, and primary workspaces; these are the areas that would be expected to have the highest probability of having elevated readings. Survey locations for any survey unit upgraded to Class 2 or 1 will be provided as needed.

7. DOCUMENTATION

Survey data will be documented in accordance with the procedures and reviews required by the DOE Contractor. A report will be prepared, describing the survey methods, results, and evaluation. The report will include the findings of the assessment, describe the materials surveyed and their condition, and justify the contamination potential classification assigned. The data evaluation will be included, along with the assessment of the quality assurance/quality control (QA/QC) documentation. This report, or a summary of the report, will also be included and referenced in the facility's baseline environmental conditions documentation.

8. QUALITY ASSURANCE

All appropriate QA/QC reviews to ensure the quality of the data gathered will be performed and documented.

Survey instruments and methods specified in applicable RADCON operating and technical procedures have been documented as to their ability to provide a 95% confidence level in detection of surface contamination at levels, which meet the requirements of this protocol. Supporting data are provided on each survey form.

Radiological Control Technicians not involved in the execution of this protocol will repeat approximately 5% of the direct and removable activity measurements on items destined for unrestricted release for verification. The results must confirm the initial findings for acceptance as satisfying release criteria.

A DOE Contractor RADCON Certified Health Physicist, or another designated health physicist, will review, evaluate, and validate the survey results, including assessment of the QA/QC information and data, prior to generation of the radiological survey report. The final radiological survey report will include the details of this assessment. It will be provided to the DOE Contractor project QA manager, project manager, and site project health physicist for approval prior to its inclusion into the Environmental Baseline Survey.

ADDENDUM D.1

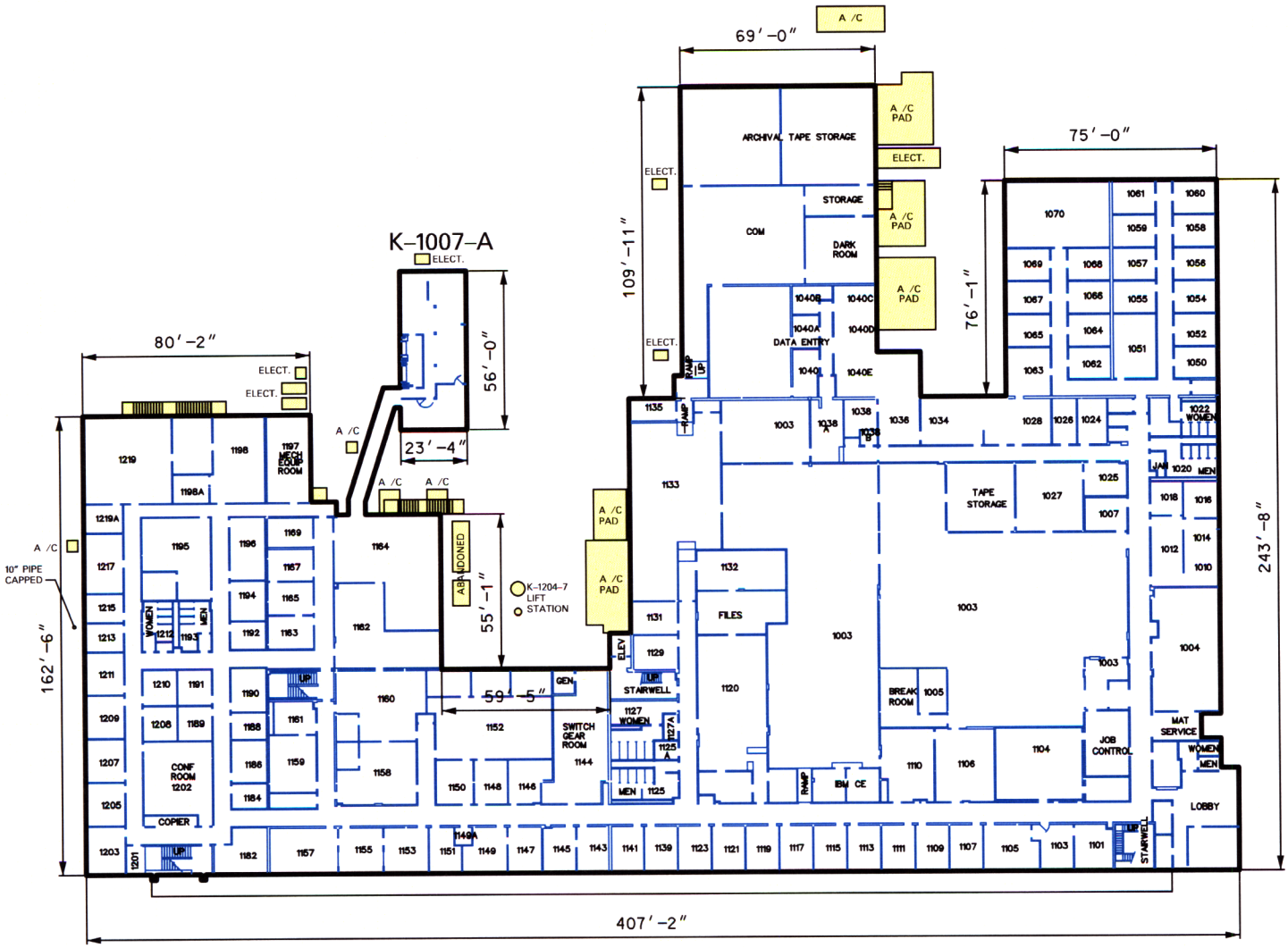
ANCILLARY EQUIPMENT LOCATED ON THE EXTERIOR OF K-1007

ANCILLARY EQUIPMENT LOCATED ON THE EXTERIOR OF K-1007

After the initial survey was completed, it was determined that several pieces of ancillary equipment located on the exterior of K-1007 that support the operation of the building will be included in the title transfer. Therefore, this addendum is being added to provide a plan for the survey of that equipment.

The equipment includes chillers, air-conditioning (A/C) units, and electrical transformers. Each is mounted on a concrete pad with associated conduits and insulated piping connected to the building. The transformers are the dry type and contain no oil. The chillers cool the glycol mixture and return it to the heat exchangers in the building to support the ventilation system.

The equipment will be surveyed as external survey units following the procedures outlined in Sect. 6.3.2 of this plan. The equipment will be separated into survey units by type of equipment (transformers, A/C units, pumps, and concrete pads) and grouped by location into three different survey units for the A/C units. All survey units will initially be Class 3. The footprint and location of the ancillary equipment is shown on Fig. Addendum.D.1.



East Tennessee Technology Park
K–1007 FIRST FLOOR PLAN
TRANSFER FOOTPRINT

Fig. Addendum.D.1. Ancillary equipment located on the exterior of K-1007.

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